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Proceedings
of the
Society of American Foresters

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Vol. XI JANUARY 1916 No. 1

CONTENTS

Forest Service Silviculture Plans ..... Theodore S. Woolsey, Jr. ... 1
The Utilization of a Tropical Forest ..... George P. Ahern 17
Notes on Forest Cover and Snow Retention on the East Slope of the Front Range in Colorado .... Norman deW. Betts 27
Chemistry as an Aid in the Identification of Species .. A. W. Schorger 33
Foresters Have a Vital Interest in the White Pine Blister Rust ..... Perley Spaulding 40
The American Forester: His Opportunities ..... Coert DuBois 48
Professional Ethics ..... B. E. Fernow 52
The American Forester: What the Society Has Done and Can Do for Him ..... D. T. Mason 59
The Forester's Duty Toward Lumbering ..... George M. Cornwall 66
The Place of Logging Engineering in Forestry ..... Judson F. Clark 75
The Lumberman's Duty Toward Forestry ..... Frederick E. Olmsted 79
Scientific Notes and Comments:
- Working Plans on National Forests ..... W. B. Greeley 84
- Weight of Western Yellow Pine Logs in Arizona .. Theodore S. Woolsey, Jr. ... 85
- The Stability of Aspen as a Type ..... Arthur W. Sampson 86
- Notes on Trees ..... W. W. Ashe 88

Reviews:
- The Testing of Forest Seeds ..... James W. Toumey 91
- A Discussion of Log Rules ..... H. D. Tiemann 93
- Tree Studies ..... Theodore S. Woolsey, Jr. ... 97
- The Rôle of Aspen in Reforestation ..... Clarence F. Korstian 103

Society Affairs:
- Reports—President, Executive Committee, Secretary, Treasurer, etc. ... 105-154
- In Memoriam: Abraham Knechtel ..... Clyde Leavitt 155
- List of Members of the Society 156
- Constitution as Amended to Date 165

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Society of American Foresters

Vol. XI JANUARY 1916 No. 1

FOREST SERVICE SILVICULTURE PLANS

By Theodore S. Woolsey, Jr., M. F.

If the development of any of the most important Forest Service policies is studied, it will become evident that the final solution has come only after initial failures. These failures have contributed to the final success; frequently the failures were necessary to a normal development. The administration of the six districts would have been a failure unless men had been trained in the district inspection period. The recasting of the too extravagant, broadcast sowing policy could come only after it had been proven—negatively. The proper classification of agricultural lands would not be possible today unless the act of June 11 had forced mistakes upon the inexperienced land examiners. Serious errors in administration have usually focused attention on the proper solution of important problems, and thus hastened aggressive and constructive action. Perhaps such a period is at hand for working plans. Thus far the policy has been vacillating. This was, to a certain extent, to be expected. Silvicultural plans must be closely linked with timber sale policy, and this sales policy had to be gradually developed. As a result of experience, suitable fire plans and grazing plans were developed quickly, because they were more urgently demanded in every-day administration. Judging from the really notable articles on the working-plan problem in its various phases, those most keenly interested in the final outcome believe that a crisis is at hand, and that the Forest Service must give the question more undivided attention. Thus far no very specific plan of action seems to have been outlined for the Service silvicultural plans beyond Kircher's summary of the District 3 official instructions. The articles for the most part generalize or comment on broad points in policy.

Under date of December 20, 1915, Mr. Greeley kindly furnished me with an official statement of the management work now under way. It is as follows:

"Our experience has demonstrated forcibly that these must be developed slowly and very largely by local officers on the units concerned. We are concentrating this winter (1915-1916) on the standardization of reconnaissance methods, which, of course, underlies any development of working plans. We will get out by early spring, I trust, a published manual on reconnaissance methods, as well as a separate and comprehensive Service publication on topographic work for all Service uses. We are pushing the timber reconnaissance at the rate of 1 million to 1½ million acres annually.

"My principal endeavor now in regard to working plans is to encourage the district officers and supervisors to prepare preliminary plans on all Forests, although largely extensive in character. The aim of these is to get the men on all the Forests thinking about the systematization of their data on resources and methods and conditions of use, so as to develop the working-plan idea in a gradual and normal way. This we hope to supplement within the next two years by the preparation of more intensive plans for two or three Forests whose use is sufficiently developed to make them desirable now. The Kaniksu National Forest, in District 1, on which Clapp started working-plan work in 1912, is one of these. Another is the Deerlodge, in Montana, where Mason started a Forest plan two or three years ago; and the third is the Whitman, in District 6, where the demand for available timber is especially strong.

"You will also be interested to know that we are going somewhat intensively into the study of water resources in relation to Forest plans and expenditures for protection. Dana now has a somewhat comprehensive study of this question in hand, in developing an inventory of the water resources of the Forests and their value. A plan prepared within the last year by District 5 for the Monterey National Forest in California goes into this question more fully and intensively than any other thing of the sort I have ever seen. We are also inaugurating, in collaboration with the counties of southern California, the Geological Survey, and the Weather Bureau, a systematic inventory of the water resources of southern California and a study of climatic conditions in relation to them, which will bear directly upon the administration of those Forests and the expenditures justified for watershed protection exclusively."

This is of wide interest to the profession. It is quite reassuring, but there is considerable doubt whether, as Mr. Greeley states ". . . these must be developed . . . very largely by local officers. . . ." To my mind, specialists, with a broad knowledge of the West, will be required before even preliminary silvicultural plans will be developed.

COMMENT ON PAST METHODS

Since it is generally agreed that the progress made in protective administration, grazing, lands, and improvement plans is quite satisfactory,

the writer will merely comment in detail on the silvicultural section of Forest Service working plans.

A number of writers have recalled that the working plans for private lands, made by the Bureau of Forestry, were generally impracticable and, consequently, were not followed. But, before pronouncing these "failures," let us consider why these plans were made. The owners wanted maps and estimates; the Bureau of Forestry wanted to advertise forestry (and secure control of the "Forest Reserves"). It seems to me that, notwithstanding faults in detail, the main objects were accomplished. My chief objection to these early plans is due to the extravagant and incorrect claims of the financial success which some of them heralded for forestry. Conservatism was lacking; the writers felt that they must show financial gain, and no doubt they believed in what they were predicting, but many of them unquestionably exaggerated future profits. All things considered, the profession must acknowledge that forestry, as a rule, is not profitable for the individual if the forest principal is properly valued. The broadest justification for forestry rests upon the indirect benefits. For this reason, I believe that the Forest Service is inconsistent in maintaining its lavish organization on the one hand and in preaching its dollar silviculture on the other. It ought to advertise more fully (and spend more time in designating) areas of forest for purely protection and recreation purposes. On how many forests are watersheds specifically reserved for city protection? How many areas have been reserved as scenic forests to become second Fontainableaus?

In response to Zon's request for opinions on the working-plan situation, notable articles have been published by Barrington Moore, Bert P. Kirkland, J. C. Kircher, D. T. Mason, and H. H. Chapman (Vol. X, Nos. 3 and 4, P. S. A. F.).

Moore's rather ambitious "Working Plans: Past History, Present Situation, and Future Development" is, to me, in some ways, disappointing. The strongest part of his article is the "Present Situation," and the weakest that alluding to "Past History" and "Future Development." This is quite natural, because only a man who has grown up with the Forest Service can realize the amount of painstaking work which the early working plans absorbed. Is it fair to disparage early private working plans? As already pointed out, they were a part of Mr. Pinchot's clearly thought-out campaign for public recognition. I feel confident that if Mr. Moore would make a careful study of the private "working plans" and woodlot reports made by the Bureau of Forestry prior to 1905, he would be amazed at the amount of good workable forestry they contained. For instance, what better method than the woodlot examinations

then in practice could have been found for inducing the small private owner to practice forestry? He received a clear-cut summary of conditions on the ground with advice on what should be done; in addition, he usually secured an actual demonstration of how the timber should be marked. I believe, also, that Mr. Moore slights, to a certain extent, the preliminary sales policy. For example, as far back as 1908 there was summarized for each Forest in District 3 the available growing stock in feet, board measure, and in cords; the amount in feet, board measure, and in cords, included in protection forests; the maximum annual cut in board measure and in cords, with the per cent this bore to the commercial stand; a summary of areas where immediate cutting should be practiced, and the policy governing future sales. For example, I find a note, under sales policy, that

"In the Magdalena Mountains (now part of the Datil Forest) free use only should be allowed. In the San Mateo Mountains, east of approximately Range 6, West, free use and local sales, with provision that not more than 10 per cent should be exported from Socorro or Sierra counties."

Today I think I am correct in saying that most National Forests lack simple policy instructions along the lines that were covered (crudely, no doubt) in 1907-1908.

Without attempting to comment on the correctness of this early (individual) forest policy, the very fact that any cutting policy at all was formally expressed seems progressive and deserving of recognition as part of Service management history. The writer, at that time (pp. 113, Vol. IV, No. 1, P. S. A. F.), wrote:

"Ten years from now this pioneer technical forestry may be ridiculed, but it is certainly true that results can be best secured by actually making a beginning, even if mistakes occur which have to be corrected in later work."

Moore mentions not at all a working plan for the San Francisco Mountains, drawn up by A. B. Recknagel; this, to be sure, was crude, but unquestionably deserves mention. I believe it had something to do with encouraging working-plan experiments (for the early attempts could be termed little more) in the Southwest.

Thus far, in stock taking, there have been two policies—one to estimate roughly and approximately all the merchantable timber (making maps at the same time), the other to defer so-called reconnaissance until it can be done accurately enough to form the basis for timber sale appraisals. The aim of the first form of procedure was to get an idea of the forests from the management viewpoint, more than that of sales appraisal; the

second plan is obviously to secure data for timber sales; in other words, we have management opposed to dollar silviculture. To my mind, the former method is preferable, notwithstanding the inaccuracies which Mr. Moore very properly calls attention to; but he overlooks the idea and ideal of the crude method in his criticism of detail. When Moore says, "It is small wonder, then, . . . that the timber plans of District 3 were not a success," I believe he overemphasized the importance that the district attached to the mere routine plan at that stage of development; it was a means to an end. His argument (p. 238) against cutting over virgin stands as rapidly as possible in order to save waste is, to my mind, a dangerous one. It seems to me that the quality prize will go to the forest cleaned of these overmature trees rather than to the forest that has intentionally conserved them as a "quality reserve." Forest pathologists agree in the cutting of diseased timber. On an area recently cut in Arizona the actual dead loss through cull (including breakage) was 22 per cent of the stand. Should a stand such as this be "conserved?"

On page 245, Moore, in speaking of Kircher's article, alludes to "his almost complete abandonment of all regulation. It is by no means an unusual point of view." I shall speak of this under sustained yield, when I explain and amplify somewhat the District 3 scheme, as described by Kircher, since I do not believe that his measures are fully understood. Frankly, when the annual silviculture supervisors plan was inaugurated in District 3 (copied from the grazing annual plan), the idea was simply to make "working plans" part of the routine. On page 250, Mr. Moore alludes to right-of-way reservations in lands classification. He urges "the essential point is that the work of selection be done, and done quickly, because agricultural land is being rapidly listed." My own idea is that rights of way cannot be selected in advance; that the only suitable method for protecting future logging is either to reserve blanket rights of way over all land listed or else to pass an adequate Federal law making it simple and convenient to condemn temporary or permanent rights of way across private land, to facilitate marketing public timber supplies. I am glad Moore calls attention (p. 251) to R. C. Hawley's working plan for the New Haven Water Company, but he omits calling attention to an extremely significant fact, namely, that, so far as I know, Yale is the only forest school (not directly administering State land) in the East that has a definite working plan for the property it is managing. Harvard has an interesting forest at Petersham, but no working plan. Practically they have an excellent scheme of management, which is:

"The fundamental policy which has control of the management is, however, fairly well defined and is based upon the essential data for a

rough regulation of the yield and the adoption of a suitable silvicultural method. We are working, as you probably know, on the basis of a sustained annual yield which has been ascertained by a volumetric measurement of the growing stock, by a tabulation of age classes, and a computation, partly from yield tables and partly from growth studies, of the present real increment and an approximation of the normal. Our progress toward the normal and a greater yield is roughly checked, both by volume and by areas—that is, the area cut and the area restocked or brought by weeding or improvement cutting into productive condition. The determination of where and what to cut must, I think, and particularly in our case, be governed somewhat by temporary or local conditions, such as changes in the market or disturbances in the growing stock, as, for example, the ravages of the chestnut disease. It is our intention to take stock of progress periodically by a remeasurement of the growing stock, a retabulation of age classes, combined with a new computation of yield."

With this excellent data on hand, as a matter of educational leadership, should not such a plan be compiled and published?

Syracuse University is in a less advanced position. As I understand the situation there, they are

"Looking for advice and plans along administrative lines. However, on account of the newness of our school we have hardly put any of these into effect, but we are gazing in that direction."

The college owns something over 1,300 acres of land, but "have not done much in the way of outlining working plans."

I merely emphasize these two cases to show that, even with small sample experimental tracts in the East, intensively managed and with ready markets, working plans have been deferred, because, to tell the truth, there apparently has been no keen demand for them. Yet the men in charge of these tracts are engaged in preaching the necessity for working plans for private and public forests. Is it a surprise, then, to think that the millions of acres of land in the western United States, some of which has hardly been described, much less studied, should be virtually without systematic plans?

On page 255, Moore goes on to say:

"If Mason's scheme of working up the silvicultural and market data into a plan for each region, as described under 'present conditions,' is adopted, these data will be just that much strengthened, and the need for a timber plan on each forest will be correspondingly reduced."

In my own conclusions under what kind of plans are necessary, I will try to answer Moore's statement by showing that the need will *not* "be correspondingly reduced."

Kirkland in an exceedingly interesting article comes out strongly in favor of sustained yield absolutely and unreservedly. Right at the start he asks the question:

"Is an approximately annual sustained yield applied to producing units of, say, fifty to five hundred thousand acres best for National Forests?"

His answer is unreservedly "Yes." Yet, in India, when virgin forests were being developed, a rigid sustained yield was not followed. It certainly was not adhered to by the French in their early administration in Corsica. They had to make large sales of practical size with the main object of improving their transportation, *since the purchaser there cooperates very largely in building them a permanent road export system.* It is unfortunate our own sales can't accomplish this!

In Bavaria, on account of an excess growing stock in mature timber, considerably more than "an approximately annual sustained yield" has been cut, and very properly. I remember, on several occasions, asking eminent French foresters why they wanted sustained yield for any one forest. The answer invariably was:

"To stabilize labor conditions, and, in the case of communal forests, to insure the village or municipality a sustained revenue."

It was very interesting, therefore, to see Kirkland's valuable statement along these lines. I do not care to comment in detail upon his conclusions without making a study of conditions on the Pacific coast, but, if his hypotheses are true, his argument for a moderate sustained yield is at least interesting, if not convincing. I believe, however, he does not place sufficient emphasis upon four points.

(1) The difference between the labor conditions in America and in Europe. In Europe "lumber jacks" usually live locally and work timber convenient to their villages. The sales are intentionally split up in small amounts to give small men a chance. In America, on account of the expense of building railroads and our large capacity sawmills, the bulk of the production is in the hands of very large companies, who do not hire the lumber jacks locally, but import them from timber regions as they become available. After a job is finished they drift elsewhere.

(2) Is there any clear-cut reason why the Federal government, for *revenue reasons,* should have a sustained revenue *from any particular forest or forests?* To be sure, it would be convenient and business-like (particularly if they lived up to a budget system) to have no great variation in returns. But is this vital? I remember asking this question of a prominent "conservateur" in France, and that his answer was: "No, as regards National Forests." Would local lumbering communities be built

up without stable and permanent railroads owned by the timber-land proprietor? (see paragraph 4).

(3) The third point that Mr. Kirkland might have considered with more detail is the reduction of the excess growing stock which must exist on many working-plan units on the Pacific coast. If the future rotation for fir is to be between eighty and one hundred and fifty years, then the need for a reduction in the growing stock at present on the ground will be all the greater where considerable forest areas may average well over three hundred years.

(4) The fourth objection to Kirkland's scheme is the necessity of government-owned transportation, if the small operator and a sustained yield is to be attained. Over a year ago the writer inquired what was the objection to the Forest Service being authorized by Congress to construct the railroad necessary to tap the Kaibab timber. There is already a partially constructed government-owned railroad in Alaska, and if it is successful, government railroads elsewhere may pave the way for the development of immense bodies of ripe timber, which, under present conditions, cannot be marketed unless a three or four million dollar corporation can be persuaded to trust their future to Forest Service contracts and officials. With government-owned railroads, small men would have a chance. There will be little railroad development by private people until the attitude of some of the States change. The Southern Pacific will build no lines in Arizona under present conditions.

I agree thoroughly with Kirkland's argument against storing up mature timber, but I should say that he went to the other extreme in advocating the forcing of government timber on the market. There is already overproduction on the Pacific coast, and forcing the market would certainly be unprofitable. Would it be fair to private owners? Kirkland brings up, however, so many interesting points in policy that it certainly justifies a formal reply on the part of the administration he criticises. His conclusions as to what plans should contain are so concise that they will bear repetition:

"The data of plans should be presented almost entirely on maps, with tabular summaries at the bottom. This applies to data covering stand of timber, soils (character and quality for Forest growth), planting data, and everything else needed. A few general summary tables should be added. Silvical data can also be presented on the maps, so as to be intelligible to the forester familiar with the region in question, on whom should rest the entire management of the Forest, except for the broad, general principles. A few typewritten pages should present all the written prescriptions necessary in the plan, which should include the regulation of the cut, but not detailed distribution, to certain compartments. The prescription in this respect should rather be merely to take

up cutting by classes of Forest based on age or condition, cutting first, of course, those silviculturally most in need of cutting."

In his article on "Regional Forest Plans," Mason is evidently actuated by the desire to avoid duplication. Much the same need was felt in District 3, when a crude attempt was made to summarize the yellow-pine practice and policies in Bulletin 101, published in 1910. A plan of having the bulletin revised periodically and republished was drawn up in 1911, in order to make uniform the general practice in yellow-pine stands in Arizona and New Mexico. As I understand it, this is exactly Mason's idea. There can be no argument that policies and field practice common to more than one forest should be made a matter of definite record by district instructions rather than have working plans made voluminous by needless repetition. I do not agree, however, with the term "regional forest plans." It seems to me it is too ambitious and misleading. I doubt if it is the panacea that Moore imagines it (pp. 255, Vol. X, No. 3, P. S. A. F.) when he states, ". . . and the need for a timber plan on each Forest will be correspondingly reduced."

Chapman contributes an interesting discussion. He states (p. 380):

"The principle of sustained yield rests on the best understood and most widely applied precept in business—that of a regulated output."

Is it not, to a certain extent, true, however, in modern business that a stabilization and regulation of output often means largely decreasing or largely increasing the output, according to the demand? This is certainly not the theory of the sustained annual yield which Kirkland clamors for. And Chapman, later (p. 382), states:

"Business necessities affecting another group of National Forests—*i. e.*, the general working plan—may necessitate the concentration of present cutting on a few forests and the *rapid exhaustion of the standing timber on such areas.*"

The italics are mine. It might be apt to call attention to the number of men who are writing, teaching, or talking the theory of management as opposed to the comparatively few men who are trying to put their ideas into effect on the ground. There is quite a bit of "crying wolf" before the wolf is full grown—but so much the better.

I wish every one might read and study these articles which I have alluded to, because my own constructive suggestions, I believe, would then be clearer.

WHAT SHOULD BE DONE

What we need is:

(A) A general management and sales policy developed in Washington.

The Forester should come out clearly and state that he believes it advisable to get rid of mature timber; under what conditions growing stock should be largely reduced; when a strict equal annual cut should be attempted (barring technical modifications). Much of this sale and management policy could probably be found in the files, but it seems to me the very fact that such articles as Kirkland's or Chapman's are published illustrates the need for a clearer exposition and argument of certain policies.

(B) With this general policy established, the district—or better, the region—will require clear-cut policies and methods for important "types." For example, District 3 could very readily draw up systems, methods of executing the marking, brush disposal, planting, etc., for the various conditions within the western yellow-pine belt. As I shall explain later, this was provided for in the district plan of 1914, under "Appendix." It would be still better to arrange for the publication of this "Appendix File" in more convenient form.

(C) Then each forest should have clear-cut management data, as Kirkland states, largely in the form of statistics and maps, with very little voluminous description. What areas should be considered city watersheds and what scenic forests should be reserved; where, on account of the danger from erosion, should cutting be forbidden; what areas should be reserved for small sales or to supply local communities or free use; what areas, in the order of urgency or accessibility, should be sold in ordinary commercial sales. This, in theory at least, should depend on overmaturity and the presence or absence of reproduction rather than on the mere desire of some purchaser to coquette with certain accessible and convenient stumpage. It is unfortunately true that, in the past at least, the purchaser has usually called the attention of a district to timber he desires to purchase rather than *vice versa,* as it should be, and it is getting to be. As far back as 1907 one of the most prominent lumbermen in California told me that, so long as the Forest Service failed to meet the practical requirements of the operator by its refusal to make sales for large amounts, it could not be considered a feasible business. This necessity for large sales is of universal knowledge. Where the mistake occurred was in not acknowledging frankly the reasons for so-called "economic working circles." If it was a departure from the sustained annual yield principle, the justification is easy to give. If this had been done, there could not be the same misapprehensions that are evident in periodical literature.

Having designated protection areas, whether for watershed, recreation, or any other cause (such as the danger of exterminating a type at its

lower limits), we have left for consideration the commercial forest. What should be done with it? My answer is:

(A) Stock-taking and mapping. This requires no argument; it is fundamental.

(B) Regulation. There should be no beating around the bush. If "overcutting" is necessary, for economic reasons, because of the overmaturity of the timber, the advanced state of reproduction, it should be clearly stated. On the Apache Forest, in Arizona, to market ripe timber it may be necessary to largely overcut the estimated annual yield, notwithstanding the present surplus in growing stock. On the Coconino the cut may just about equal the production of the unit if the needs of existing mills (which the Service has encouraged the establishment of) are to be met. On the Prescott, in a valley bordering an isolated farm community, where the growing stock has been dangerously reduced, it may be necessary to economize and cut less than the annual yield. In other words, I believe that right here is where "the regional plan" alone falls down. *There is need for intelligent common-sense directions for each and every unit.* Quite often, as our timber business increases, special working plans for watersheds will be urgent. Such a case is admirably illustrated by the "silvicultural management of the Rio Pueblo and Rio Santa Barbara watersheds, Santa Fe National Forest," by Clarence F. Korstian (August, 1915). Here were some specific problems to be met before an exchange form of timber sale could be properly administered. These problems were fundamental and required intelligent and systematic, scientific study on the ground. The conclusions (not yet approved officially) show with sufficient clearness the scope of the dilemma:

"1. The present management cutting is fully justified from the standpoint of silvicultural management. The removal of much overmature and surplus growing stock is being secured at a stumpage value equal to that received from other large sales in District 3.

"2. All of the commercially important forest types on the Rio Pueblo and Rio Santa Barbara watersheds of the Santa Fe National Forest should be managed on hewn-tie rotations, because tie timber is worth over $2 per thousand feet, board measure, more than saw timber on these watersheds. A modified form of the selection method should be used in the silvicultural management of these areas. A flexible diameter cutting limit of approximately 14 inches should be adhered to, because 14 and 15 inch trees are the optimum sized tie trees.

"3. Tentative rotations of 120 years for western yellow pine, 150 years for Douglas fir, and 130 years for Engelmann spruce are recommended for the logging units dominated by these respective species or types. These species have passed the period of maximum accretion before the above ages have been attained. The mortality per cent is smaller in a

short rotation. A short (hewn tie) rotation is also more desirable from the pathological standpoint.

"4. The western yellow pine and alpine types can be managed on cutting cycles of ten years. In the Douglas fir type the next hewn tie cannot be made until the expiration of approximately 20 years, and then hewn tie cuttings can be made every ten years thereafter.

"5. The remaining saw timber in the western yellow-pine type can be profitably logged in approximately 30 years; that in the Douglas fir type in approximately 40 years, and that in the alpine type in approximately 50 years, the exact time to be determined by the principal species or type; after which time no more saw-timber cuts are contemplated. The small amount of timber above hewn-tie size which will accumulate on the areas can probably be worked into split ties when it is ready to be cut.

"6. The future watershed protection of these areas is assured by the extent and character of the forest cover which is left, provided that adequate fire protection is maintained. The importance of the fire plan cannot be overemphasized."

I believe Korstian's report (which I trust will be published in full) contains a good deal of sound forestry, and yet, unfortunately, nothing is said in the conclusions of sustained annual yield. The Forester states in the official working-plan policy (p. 113-S, "The National Forest Manual"):

"Intensive methods like the management of timber so as to secure a sustained yield should not be attempted until required by the demands upon the forest or other conditions affecting the use of its resources."

While this is poorly worded, the idea can be gleamed; but the statement on page 114-S is most unfortunate:

"Timber reconnaissance will be restricted to areas in immediate demand for purchase, or which must be estimated to complete a working plan required to provide for urgent local needs."

As I understand this policy, it signifies that nothing but timber sale reconnaissance can be started because of lack of funds.

How can intelligent regulation be attempted with a policy like this? Lack of finances undoubtedly prompted this unfortunate sentence. I hope it will be stricken out when the manual is revised, and that a real effort be made to secure the funds necessary for stock-taking and regulation. This is something for Congress to correct. Does game protection justify the spending of $2,000 in a district when money is lacking for such fundamental management data?

(C) Regeneration, as emphasized by the National Forest Manual and by Chapman, is the all-important consideration in forest management. It is the key to the sale policy on the European forest. Have we given it enough thought and attention? I think not. When Mr. Pinchot was at the head of the Service, he used to harp on regeneration because of his

European training, and I believe he did a great deal of good in placing the emphasis where it belonged. No further amplification of this topic is necessary.

(D) Commercial aspects. Before the commercial policy of any forest can be established a regional market study is necessary; and, moreover, it must be kept up to date because market conditions change. One of the reasons for Germany's commercial success was that they were scientific students of market conditions. It would certainly be illogical to plan a large sale on any forest without knowing what was to become of the expected product after manufacture commenced. The establishment of too many mills may be a grave error, even if competition results in higher prices and in the final squeezing out of the weaker company. Much the same sort of studies are necessary, as, presumably, the Standard Oil makes before it contracts for plants to increase its production. Intelligent, common-sense regulation of milling facilities seem necessary, but the ideal cannot be attained until, as I have pointed out, government-owned means of communication are available to the man with moderate capital. On the whole, I believe it would be better for the locality to have ten mills cutting 50,000,000 a year rather than one mill cutting 500,000,000.

(E) Annual plan. The "S" annual plan is my own pet and I hope to see it result in success. It is merely translating into a convenient form of routine certain silvicultural information formerly required each year at different times. One reason why sales management has not been more successful is that no convenient form of routine has been devised to make it a matter of every-day administration. It has been made a project and pushed to the background. I am glad to see that Mr. Kircher has already reported that annual plans are in successful operation in the Southwest. One of the chief functions of the annual plan is to keep the card (or sheet) record up to date.

As Kircher explained, the District 3 preliminary plan (really a means of putting into effect the results of stock-taking, regulation, regeneration, and market study) has for its main basis card (or sheet) records, map records, permanent (regional plans) appendix records, and preliminary plans by specialists working in close co-operation with the supervisor. The card (or sheet) records included classification of types in acres, classification of saw-timber types by species, summary of estimates separately for cord-wood and for saw timber by species, summary digest of timber-sale costs, record of stumpage rates in advertised sales, maximum and minimum stumpage prices; record of timber cut and timber sold, separately for green and dead, giving the amount and its total value; a similar record of the cord-wood business and free use; a record of yield

regulation separately for saw timber and cord-wood. The yield regulation sheets are illustrated by the following for saw timber; it might be stated that the basis for the allowed cut should be stated on the reverse of the record sheet:

Record of Yield Regulation—Saw Timber,.....National Forest

Fiscal year.	Allowed cut.	Green timber cut or destroyed.			Total.	Surplus or deficit.
		Sales.	Free use.	Losses.		

The records also included a summary of prices f. o. b. cars at the mill by grades, together with the average mill run; a summary of the percentage of grades; a summary of sowing and planting; a list of species occurring on the National Forest, and, perhaps most interesting of all, a *cumulative report* of the stand for each district on each forest. The tentative scheme is shown on the following sheet:

FORM S15. CUMULATIVE REPORT OF STAND (BY LOGGING UNITS) IN M. B. M.

Watershed..... District.....

Logging Unit..... Forest.....

Forest Plan Division.....

	Stand 19...	19.....			19.....			19.....		
		Cut.	Loss.	Net stand.	Cut.	Loss.	Net stand.	Cut.	Loss.	Net stand.
Y. P.										
D. F.										
W. F.										
E. S.										
Misc.										
Total.										

To be cut.....%.

To be left.....%.

No. of cords.....%.

Per cent of error in estimates.....

It seems rarely to have occurred to government foresters that, after complete stock-taking was made, it was absolutely essential to have a systematic method for keeping track of reductions in this stand on watershed by cutting, by fire, by wind-fall, etc. For example, if Forest Service estimates are referred to in Washington, I have no doubt but that an employee of the Service could take a section that he knew to have been cut clean in a recent timber sale, and yet find an estimate of perhaps six or seven million feet of yellow pine. What is the value of estimates in regulation if they are not kept up to date?

It makes little difference whether these permanent records, which have been briefly alluded to, are kept on ordinary letter-size sheets or whether they are tabulated and entered on township plats of tracing linen. The details must be worked out by those whose duty it is to inaugurate economical business methods. The map records have already been described in sufficient detail by Mr. Kircher. The permanent appendix records referred to are merely another name for Mason's "regional working plan." They were supposed to be an accumulative record of local policy applicable to all forests. Some more convenient form could undoubtedly be devised. The next step is the preliminary plan described by Kircher, and unquestionably the proper forms which this plan should take under varying conditions can only be determined after samples have been produced by some genius. It will take a genius to produce something that the supervisor will use. If it is too complicated, he can't possibly make use of it. If it is merely a statistical tabulation without the human element of justification for the measures recommended, then it will not be a live issue.

In the District 3 instructions (drawn up February 1, 1914, by Kircher and myself) the following statement represented our ideas at that time on the regulation of yield. I am quite sure that both of us believe in yield regulation, although Mr. Moore evidently misunderstood Kircher's article. The extract from the proposed instructions which follows *was necessarily in harmony with Service policy which emanated from Washington* and which has already been alluded to in a quotation from the National Forest Manual:

"*Regulation of Yield.*—The first step in the management of the National Forests under existing policy is to sell the overmature timber that is deteriorating and to develop a net revenue. Therefore yield regulation must be secondary to the silvicultural requirements and to market. It is also clearly valueless to impose a local limitation of cut which is impractical because of the necessity of a large annual cut to justify commercial logging. At least until the overmature timber is removed, therefore, the policy of an (rigid) annual sustained yield will not be applied;

even a periodic sustained yield will not be attempted until it is clearly and positively necessary for reasons of public policy. In other words, we will not damage the National Forests silviculturally to pursue an academic ideal of sustained annual yield. It will be the duty of all forest plans officers to protect small local communities and settlers who are dependent upon the local forest resources for their needs and who cannot reasonably be expected to import. Where a mining camp, for example, requires more than the estimated annual growth, it must be clearly proved that the future development of transportation will not allow imports to relieve this demand before a refusal to supply present export needs (from an overmature stand) is sanctioned.

"In the discussion of the yield problem, however, it will be advisable to check the practical requirements with an academic estimate of the yield capacity by formulæ, volume, area, and such other theoretical checks as can be applied."

I still believe this policy (if properly interpreted and supervised) is thoroughly sound.

If any of the teaching force are interested in the details of the above District 3 instructions, I am sure the district would be glad to supply them upon request. Lack of space forbids further amplification.

The more I have traveled and studied forestry, the more I believe in simplicity. The greatest improvement in working plans will be when they are reduced to the simplest possible form, and if they can cover stock-taking, regulation, regeneration, commercial requirements, and annual routine, a decided step forward will be made. But I want to sound a note of warning to those who believe that the problem can be solved by generalization. Policy generalization and regional generalization is all right only if backed up aggressively by carefully thought-out and specific directions on management and timber-sale policy for each forest or watershed. Every professional forester should demand reasons for cutting or for not cutting. To do otherwise will sacrifice fundamental and systematic business efficiency, which can only result in failure in the long run.

(*January 23, 1916.*)

THE UTILIZATION OF A TROPICAL FOREST

By Major George P. Ahern

Delivered before the Society December 16, 1915

The acquisition of Latin and Oriental territory after the war of 1898 involved the Americans in problems which included the study and development of tropical forests. The administration of other tropical colonies was studied by American officials in order to profit by their experience. But the Old World has always shown much conservatism in its attitude toward the native and his development. It has not had sufficient interest in matters of education and self-government, sanitation and hygiene. This conservatism was shown in forest development throughout the tropics. It was found in the Philippines as elsewhere. This I realized when undertaking, in 1900, the organization of the Bureau of Forestry, as ordered by the Military Government at that time. There was very little accurate knowledge of the forests, their extent or their value. The archipelago, covering an area of more than 115,000 square miles and containing more than 3,000 islands, lies stretched from north to south for more than 1,100 miles, inhabited by people with different customs, speaking many dialects, and with but little intercommunication.

The Bureau was organized, and, as its chief, I realized the great responsibility of caring for 60,000 square miles of tropical forest, when its commonest products were unknown to me. I did not know even the common or scientific names of these products, but there was no one else available to do the work. The Governor's office intimated that it was not familiar with forestry matters, and that I was to work out my own salvation, as far as the Bureau was concerned. We found, to begin with, a great confusion of common names as applied to forest products. More than 6,000 such names are now listed in the Manila office; one wood, molave, *Vitex parviflora,* having upward of forty different names. This confusion of names, added to our lack of knowledge of the country, language, people, and their customs, combined to make the task of the forest officers difficult, though full of interest. What was needed for the ensuing problems of administration and research was a corps of efficient, studious, and zealous foresters, a well-equipped laboratory, and a library—all of which were lacking. Even the herbarium and wood specimens collected by the former service had disappeared, as well as the

forest maps. To add to the difficulties, a wide-spread insurrection made life on the trail somewhat hazardous, not to mention incidental dangers, such as typhoons and floods, head-hunters, crocodiles, and last, but not least, cholera and other dreaded tropical diseases, each of the above items claiming its quota from the employees of the Bureau. But, in spite of all difficulties and dangers, the men stood bravely to their tasks, never faltering in the work assigned them.

As a first step, there was gathered together all of the available forestry literature of the former service. The former laws and regulations were translated and re-enacted, with some modifications. There was also issued a compilation of notes on important Philippine woods, as well as a compilation of the public land laws.

In the Philippine forests up to this time the most primitive methods had been in use, the native lumberman seeking with his carabao a few highly prized woods, widely scattered through dense virgin forests, which seemed scarcely touched by such logging methods, nothing larger than medium-sized trees being taken.

During the former régime this system supplied such small demand as had existed, but with the impetus given to general construction after the arrival of the Americans, it was found that the yield from such a system was hopelessly inadequate. The American contractors and engineers, as well as those native to the country, deemed certain woods indispensable for important parts in general construction. A more liberal list was provided for unimportant uses. It was evident that a greater supply of native woods was necessary, and that the list of uses of woods should be radically changed, so as to provide suitable woods that could be supplied in quantity. At one time the construction of some 800 school buildings was suspended for the lack of woods required by the building specifications. The Bureau took the matter in hand, gathered together from every corner of the Islands all data, and published the information in the form of a bulletin, "The Uses of Philippine Woods" (No. 11). The situation was immediately relieved, as some 140 native woods were cited and their useful qualities stated. Where, for instance, but three or four woods had been specified for flooring, the new list mentioned fifteen suitable woods, and some twelve others used locally.

As the field-work progressed, many interesting facts were developed, chief of which was that the bulk of the standing timber was composed of some twenty tree species of the dipterocarp family. A few of these species were popular in the market, but the majority were unregarded and were given the most unimportant places in general construction, while some were not used at all. In 1902, in order to make known the

useful qualities of these abundant but unpopular woods, a timber-testing laboratory and a workshop were established. An elaborate series of timber tests was conducted under rules similar to those laid down by the U. S. Forest Service, so as to afford a basis of comparison with well-known American woods. The results were published in Bulletin No. 4, issued in 1904. In the workshop the woods were made up into various forms, such as furniture, implements of various kinds, parts of house construction, railroad ties, etc., so as to show in a practical way their useful qualities. A series of durability tests was started at this time. A vigorous campaign was inaugurated through the public press and through general correspondence to make these woods a feature in the world's markets. Circulars and bulletins were published. Advantage was taken of all carnivals, fairs, expositions, etc., to make attractive displays. As a result of this propaganda, the output steadily increased and the market widened. We were now shipping lumber not only to China and America, but to India and Europe as well. With gratifying results the main policy was succeeding, viz., to find a market for the abundant but unpopular woods. Two of these woods (apitong and lauan) had at last found favor in foreign markets. Their output increased fourfold from 1905 to 1913.

As to the actual development of the forest, it was deemed wise to attract large capital, in order to insure the means for the fullest and most modern equipment. How this succeeded will be told later on in this paper. At the outset we were told that modern logging methods were not possible, owing to the small average yield per acre. We found, indeed, very primitive methods of haul. Narrow-bitted axes were used, the virtues of the two or four-man saw in the woods not being appreciated; rattan was employed for cables, and these methods were accompanied by a total lack of system or regulated measures to meet the fast-growing demand of the ever-widening market. The mills throughout the tropics up to 1904 rarely cut over 20,000 board feet per day. The system of logging and transportation made it impossible to do much more than that. When the large stands of dipterocarp woods became better known, it was deemed advisable to inaugurate modern logging methods. In 1903 the first large forest tract was cruised with this in mind. Early in 1904 a lumber company was given a 20-year exclusive license to operate. Under the terms of the contract, logging railroads, donkey engines, wire cables, saws, and a modern mill of large capacity were to be installed. This was, as far as we can learn, the first modern logging and milling operation in the tropics where use was made of logging railroads, etc.

A number of other large tracts were then studied and mapped. Pre-

liminary working plans were made for prospective investors. The tracts were of sufficient size to warrant a permanent operation and not merely for the period of the license—twenty years. The present plant in northern Negros has an actual daily capacity of more than 100,000 board feet of dipterocarp lumber. The yield on this tract averages 40,000 board feet per acre. From this mill a recent shipment for the foreign market amounted to one million feet of lumber, much of this lumber composed of the formerly despised lauan, now commanding mahogany prices. The wasteful circular saw has been replaced in the leading mills by the band saw. In Manila the visiting American lumberman is shocked to see hand sawyers making good wages under the shadow of modern steam mills. He is soon convinced that there is a good reason, inasmuch as the difference of saw kerf of the hand and circular saws is as 8 to 25, the hand sawyer also using every scrap of the log, even to the very thin slabs, which are often used in inconspicuous parts of furniture.

In the meantime, while the work in the Islands was being thus modernized and methodized, the export trade was found not to be thriving as it should, owing to faulty manufacture, carelessness in filling orders, and lack of inspection and grading rules. With a view to correcting this condition, the lumbermen were urged to form an association, adopt grading rules, and exercise more care in building up an export trade. But no action could be gotten until the percentage of rejected lumber became so great that the trade was threatened with annihilation. The presence of several inspectors from the Hardwood Association of the United States effected an immediate cure. No further rejects were reported and the foreign trade is now growing steadily.

In order to provide for native inspectors, several graduate rangers were assigned to each American inspector to learn the grading of export lumber. After a sufficient number are trained, the Philippine government will be in a position to grant requests for government inspection of export cargoes, which up to the present have been denied, owing to the lack of government inspectors and grading rules.

The necessity for research work was felt from the very beginning and every effort was made to accomplish as much as the limited funds and personnel would permit. This work was placed in charge of a division of investigation, which now has its headquarters at the forest school, at the foot of Mt. Maquiling. This mountain of 15,000 acres has been set aside as a forest reserve and offers many opportunities for local research work and as a demonstration ground for the students of the forest school. Here are located also a forest nursery and tree plantations, maintained largely by student labor. The members of the division of investigation constitute the teaching staff of the school.

Much of the progress in research work must be credited to the Bureau of Science, which, with its fine equipment and experienced men, has cooperated so cordially and thoroughly in every line of investigation.

One of the first requests for investigation which came to our Bureau of Forestry was of the gutta-percha and wild rubber collected by Doctor Sherman, one of our employees. Then followed studies of mangrove products, such as the calorific value of its woods, which are the chief source of fuel of the natives; then followed dyewoods and dye barks, tan barks, nipa-palm products, wood oils, gums and resins, wood and bark fibers, and paper-pulp material. Good paper was made from several native woods, from coarse grasses which cover 48,000 square miles of the archipelago, and from caña bojo, a small bamboo. The results of this research were given wide publicity and brought to the attention of the public in a very practical way the extent, value, and uses of these forest products. One of the great sources of forest wealth which up to the present has not been duly appreciated lay in the mangrove swamps, which extend over an area of from 1,000 to 1,200 square miles. Their wealth consists principally in their timber, fire-wood, dyewood, dye bark, tan bark, and nipa-palm products.

One of the concessions was for 2,000 acres of mangrove swamp, granted to a mining company as a means for producing a fuel supply for the mining plant. The terms of the concession provide for cutting rules and replanting all blank and thinly covered spots on the tract. Before this concession was granted it had been observed that the native owners of mangrove swamps near Manila cut annually a large crop of firewood, basing their cutting on a 7-year rotation.

The nipa palm, *Nipa fruticans,* another mangrove product, grows in tidal swamps in almost every province in the Islands. It produces a leaf which is extensively used for thatching and for the walls of houses. The sap, when fresh, is used as a beverage; as vinegar when fermented, and as alcohol when distilled, 2½ million gallons of proof spirits having been obtained from this source in 1913. About 10 gallons of sap are gathered during the season from each stalk, of which there are about 800 to the acre. The Bureau of Science made an exhaustive study of nipa and all its uses. The results were published in the Journals of Science in 1913.

Another valuable product of the swamp is found in its tan barks, taken from two species of *ceriops* and two of *bruguiera,* which occur in large stands. Analyses made in Washington of the bark of these trees show as high as 39 per cent of tannin. Other tree species in and out of the swamps produce tannin in smaller quantities. The tanning industry

in the Islands is not well developed. Locally, infusions of these barks are used to dye cloth, fish nets, sails, mats, etc. It gives a color ranging from red to a deep brown. The method in use in the tanneries of Manila is to soak the hides with small pieces of bark, about 2 inches square, for 30 days, in water. About 10 piculs of bark are used to tan 16 hides. Tan bark is ordinarily put up in bundles weighing about one picul (133 pounds), of pieces 3 feet long and 3 to 4 inches wide. The wood of these species makes excellent fire-wood and is used extensively for that purpose. The practice of the Bureau is to grant tan or dye bark licenses only to persons who would also utilize the trees stripped of their bark for fire-wood. In 1902 some 450 tons of tan bark were gathered; in 1909, 3,600 tons; in 1912, but 970 tons.

Of dyewoods, there is at the present time but one important species in the Islands. This is sibucao, *cæsalpinia sappan,* or sappanwood. This is most often planted, and the bright-colored heartwood is the portion used.

Rattan is represented by several species of *calamus, dæmonorops,* and *korthalsia.* These long and slender palms are found in large quantities in the primeval forests throughout the world. They are found from sea-level to 2,000 meters in altitude and from 30° N. to 30° S. latitude. Upward of 850 licenses are granted annually for this one product alone. One of the most useful products of the Islands, as far as the native is concerned, is the rattan.

The uses to which rattan is put are varied. The smaller canes are used for basket-work, hats, chairs, tables, and furniture generally. The longer canes are used for fenders for ships, cables, ropes, bridges, screens, floor coverings, for tying large bundles, even for tying rafts, for house-building, fish traps and fish stakes, and endless other purposes. Where the builder in America would use nails, screws, bolts, wire, etc., the native in the tropics uses rattan. Native houses and boats are built without a single nail. The supply of rattan has never yet met the demand. The wild tribes do most of the collecting. Other natives also engage in the work when not otherwise occupied. The cane is cut into lengths of from 12 to 16 feet and tied in bundles of 100. The grades depend on length, thickness, color, condition of coat, and place of growth. The small, flinty-coated, light-colored cane is prized by the market for use in furniture-making. The best grades are found on hill and mountain sides, the product from the flats being coarse and not so tough. A good grade suitable for furniture manufacture must be, to quote from a representative of a leading Singapore firm, "of matured rattan, strong and not ribbed, not high-jointed, of length from 12 to 16 feet. Bright color is desirable, but not absolutely necessary, except in high quality. Diameter

should be 3/16 to 3/8 of an inch." Singapore is the central market for rattan. The Philippine rattan goes there via Borneo, is split and cleaned by machinery, and then shipped via Hongkong back to the Philippines for sale in the Manila market, where it is sold at 25 to 65 cents per kilo, the raw product having been sold in Singapore from 2 to 10 cents per kilo. The Philippine government is now taking active measures to have the local product manufactured at home.

The annual imports of rattan into the United States since 1900 have averaged about one million dollars in value, of which import the Philippine product was comparatively insignificant. Ninety per cent of the rattan exported in 1914 went to Singapore, and part of the remaining 10 per cent to the United States. In 1914 the 852 rattan licenses produced 3,600 tons of split rattan and over 10 million meters of the unsplit article. There are a few small factories in the Philippines where rattan is split and cleaned. It is employed in the furniture shops in Bilibid prison and in the trade schools maintained by the Bureau of Education.

To the native the most indispensable forest product is the bamboo. He builds his house of it; from it he makes many household and agricultural implements, as well as his furniture; it also furnishes material for hats, baskets, mats, fishing rods, pingas, tying material, objects of native art, bridges, arches, rafts, and endless other uses. The tender young shoots even serve as a food. It also makes a valuable paper pulp. A study of an area of caña bojo, a small bamboo in Bataan, brought out the fact that an area of 5,000 acres of caña bojo would supply permanently a pulp mill of forty tons daily capacity. This provides for cutting on a three-year rotation.

Bamboo less than a year old is rarely cut, as it shrinks and stains easily and is up to that period subject after cutting to insect attack. Where toughness, elasticity, and durability in general construction are required, two to three year old bamboo is used. The natives state that the best months for cutting bamboo are December, January, and February.

A Filipino workman made a good-looking settee for me, using merely his bolo and one bamboo. The wood cost but a few cents, and, added to the wages of the workman, who spent less than half a day on the job, made the total cost a trifle, as the usual daily wage in the locality is but 25 cents.

Among the other minor products are the gums, resins, and wood oils, the most important of which is almaciga, or gum copal, the hard resin of *Agathis alba*, a tree of the pine family. This tree, found in the mountains, often reaches a diameter of 6 feet and a height of 150 feet. Almaciga is obtained by slashing the bark of the tree, from which the

resin flows and accumulates in some quantity. By far the largest quantities are obtained from the ground, and at times long after the original tree had disappeared. In gathering this product the native uses a stick, which he pokes into the ground until he strikes a piece of almaciga. More than 1,300 tons of this product were gathered under license in 1914. It is shipped to Europe and the United States, to be used as an ingredient of fine varnishes. It is used locally for making varnish, occasionally as an incense, and also in torches. For the latter purpose it is wrapped in a palm leaf in cylindrical form; it burns readily, giving a rather bright but smoky flame. In preparing this product for market, it is sorted into four to six grades, according to color, size, and absence of impurities; occasionally pieces of this gum are brought to market weighing more than 100 pounds.

From the pili tree (*Canarium luzonicum*) is obtained another valuable resin, known in the markets of the world as Manila elemi. A large part of the world's supply of this product comes from the Philippines. The supply has never equaled the demand. The resin is extracted by slashing the tree with the native bolo. The flow is on an average of from eight to eleven pounds of resin per year. It is used medicinally in the preparation of ointments and plasters, and to some extent in the preparation of varnishes to give toughness. Recently it has come into use in the preparation of lithographic inks.

Resins from dipterocarp and other trees are produced in the Islands and are used locally for calking boats and for torches. Some of the dipterocarp trees, apitong and panao, yield some liquid resins, or so-called wood oils, known as balao or panao. Their principal use is for making the putty used in calking boats.

A true wood oil is produced from the supa tree, *Sindora supa,* fam. leg.; 117,561 liters of wood oils were collected and used locally in the Islands in 1914.

A further minor product is gutta-percha, a milky sap of various members of the family sapotaceæ. The members of the genus palaquium produce the best grades. In June, 1901, I received authority to send Dr. Penoyer Sherman to Java, Singapore, and Fed. Malay States to study the laws and conditions under which rubber and gutta-percha were grown, collected, and marketed. Upon his return, some months later, he was sent to the southern Philippines to repeat his investigations and to make collections of herbarium material and samples of the various kinds and grades of gutta-percha and rubber found there. It had been stated in various publications issued before that time that the best grades of gutta-percha were not found in the Philippines. Doctor Sherman's collections proved the contrary. Eighty-five tons of this product were

collected in 1914. It is used in the preparation of submarine cables, handles for surgical instruments, golf balls, dental supplies, and high-grade substitutes for rubber.

Wild Philippine rubber is produced from various vines, the principal of which are species of chonemorpha, *Parameria philippinensis*. The collection of wild rubber does not seem to be at the present time a profitable undertaking. Rubber planting, from which a high-grade product is produced, is thriving in the southern Philippines.

On the whole, the development of the minor products has not proceeded as satisfactorily as the timber industry. Promising results await the investor who takes up understandingly the manufacture of cutch, the preparation of rattan, the distillation of alcohol from the nipa palm, and other enterprises where the raw product is accessible and abundant, for labor is adaptable, efficient, plentiful, and comparatively cheap.

The development of tropical forests in its beginning is a slow process. All of them present the same problems, and attempts at their solution must be made with but meager data. Research should take precedence over other work for the first years; but in order to secure funds from legislators, it is necessary to make a showing of immediate financial return. The average legislator is averse to appropriating money for scientific research when funds are scarce and needed for public works, agriculture, commerce, and other, to his mind, more urgent fundamental needs. He demands immediate returns for the funds appropriated, and this accounts for the fact that the Bureau of Forestry in the Philippines turned in a substantial surplus over expenses from the first year of its existence; otherwise the Bureau would have received very little encouragement.

The preliminary work in a tropical forest should be conducted by a forester who is a keen forest botanist. All botanical, all log, and minor product collections should be made with the ultimate management plans in mind—plans which contemplate a modern lumbering operation. Possibly two years will be required before sufficient data are available to warrant the installation of a modern plant. Eight to twelve months will be spent on the reconnaissance and report, and the next twelve months will be required in the timber testing and other laboratories and workshops. The logging and milling company will then have some idea of the extent and value of the forest to be developed. From the usual reports received at present we learn but little of the extent and value of a tropical forest. Rarely is a report, especially on a Latin-American tropical forest, based on valuation surveys or mention made of the soft or easily worked hardwoods. Light, easily worked woods are found in the tropical forest; also some hardwoods that are easily worked. The

aim of the forester in charge should be to find a sufficient number of usable woods aggregating at least 10,000 board feet per acre. The native softwood is condemned by the inhabitant of the tropics unless it is a cedar or a mahogany; the valuable hardwoods are condemned by the mill superintendent, for high speed and hardwoods are not a good combination for the saw. How often have I found mills in the Philippines struggling with make-shift saws, having ruined their full supply on some unknown log. The sawyer in that country has now learned his lesson and, before he attempts sawing a new wood, sees that his shafting is secure, and then moderates the feed, feeling his way, so to speak, in case an ugly twisted fiber or hard resinous or other deposits present difficulties. With care no difficulties are found in sawing some of the very hard woods.

After the St. Louis Exposition, I wished to have resawed some half dozen 7-inch planks. I took up the matter with the owner of a hardwood mill and he agreed to do the work. My intimation to him to be careful of the speed of the saws and to look after his shafting met with the reply that his mill was a hardwood mill. That same evening a telephone message from the owner notified me that he had broken three saws, and that the planks were full of nails. Needless to state, it would have been impossible to drive a nail into such planks. I notified him that such woods were sawn readily in the Philippine mills, but that they required different treatment from mahogany and cedar.

I have in mind one of several virgin forest tracts as they appeared before the hum of the saw was heard. A special steamer was needed to make our first visit, as it was far from commercial routes. The people in the vicinity had an evil reputation; pernicious malaria and other dreaded evils were reported; there were no roads or trails, no horses or other transportation, no food to be had in the locality; in fact, the country was exactly as it had been a thousand years before, waiting for some one to come waving a magic wand and wake the place to life, for it was teeming with possibilities and latent wealth. The tract being deemed worthy of a cruise, the forester and his party arrive, packs are dropped, and tree counts, botanical and other collections started; topographic and other data are collected, and the frightened Negrito or other savage occupant of the woods little realizes that the age of progress has arrived, and that the quiet of former ages is no more. The surveys and reports completed, the contract is let and the lumber company takes charge. Then the company's steamer begins its regular trips. Soon a great plant begins to grow. Hundreds of employees make this their new home. The steam whistle is heard and the logging train is ere long startling the denizens of the jungle from their long sleep. The country throbs with a new life that spreads in all directions, as agriculture and commerce follow promptly in the wake of the pioneer company.

NOTES ON FOREST COVER AND SNOW RETENTION ON THE EAST SLOPE OF THE FRONT RANGE IN COLORADO

By Norman deW. Betts

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The benefits derived from forests vary almost as much as the conditions under which a forest will grow. In one locality its products may be the basis of thriving industries, whose prosperity, and particularly whose local existence, depends on the maintenance of a supply of timber. In another the prevention of erosion, the saving of soil accumulated on mountain slopes through untold ages, may be the feature which maintains continued production in both upland forests and lowland farms. In more restricted localities the value of permanent natural conditions for recreation purposes becomes of first importance, especially as the opportunity for enjoying them close at hand becomes less possible and the benefit becomes more appreciated. In many of the Western States, where irrigation has made valuable every drop of available water, the part that the forests of the mountains plays in maintaining the summer flow of the streams is of great importance and of direct bearing on the proper management of the forest.

Much has been written regarding the influence of forests in general in conserving stream-flow, and many different opinions have been held as to their value in this regard. It is possible that the question may be a local one in some of its phases, and especially in regard to the influence of snow retention on stream-flow. There is certainly no question as to the importance of any factor that will aid in conserving the water supply of the mountain States. The following notes are the result of some observations made in Colorado in 1911 and 1912. Their aim is to call attention to the effect of the spruce type of forest in retaining the snow at high altitudes—a point that seems to have been overlooked in most of the discussions on this subject.

In a consideration of the disposition of snow in a mountain region, the factors which bear both on the formation of the deposits and on their retention must be considered. Those affecting the deposit of snow are chiefly the precipitation, the wind, and the character of the surface, both in regard to topography and surface cover. The most important factors that influence the retention of the snow are the evaporation from exposure to wind and sun and the melting due to rain and the temperature of the air.

The precipitation[1] by months is shown graphically in figure 1 for two stations in the region under consideration—one at Boulder, on the edge of the plains, and the other at Corona, a little above timber-line. The difference in the precipitation at these places, which are only 25 or 30 miles apart, brings out roughly the influence of altitude on the precipita-

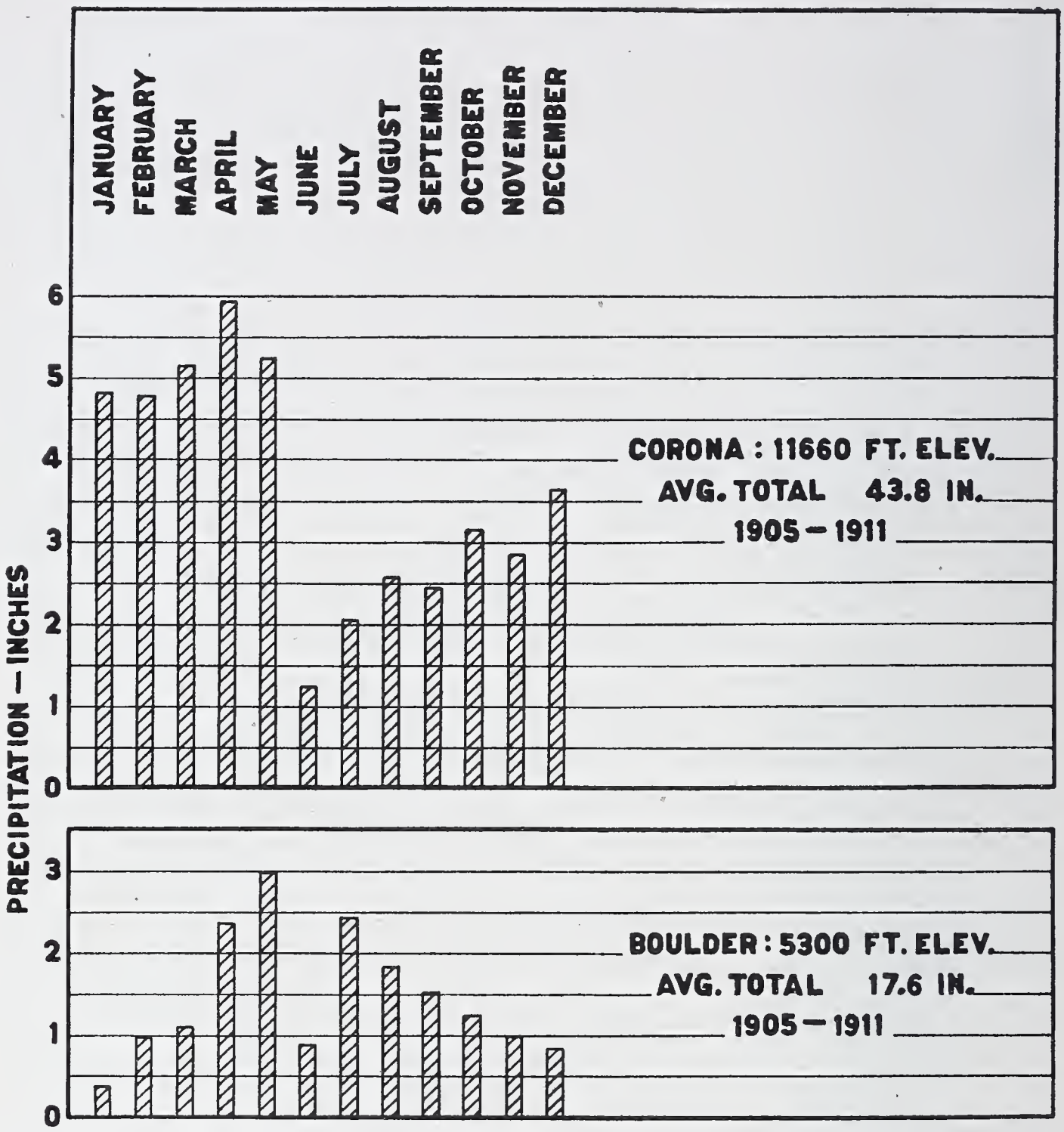

FIG. 1.—*Precipitation on Continental Divide contrasted with that at base of mountains*

tion, and therefore the importance of the upper belt of forest in respect to its location in a region of heavy precipitation. By far the greater part of the precipitation that falls in the upper belt of forest and above timber-line is in the form of snow. This is brought out quite clearly in figure 1. Corona is situated on the Continental Divide above timber-line and a few

[1] Precipitation records are from the reports of the U. S. Weather Bureau.

miles south of the region in which the photographs accompanying these notes were taken. The distribution of precipitation throughout the year is probably much the same in the adjoining belt of forest.

The winds are very strong in the higher altitudes and have a marked influence on the final disposition of the snow. Their direction is chiefly toward the east or down slope, as may readily be determined by an inspec-

FIG. 2.—*This view shows the drifting form of snow deposit characteristic of the upper belt of forest*

Taken July 6, 1912

tion of the form of growth of the "wind-timber" at the upper limit of tree growth and by the location of the snow-drifts.

In the region under consideration the surface presents a rugged appearance, and flat forested areas do not form a characteristic feature of the topography. This fact is of importance in regard to the formation of drifts. The statement is frequently made that the forest tempers the wind in such a way as to prevent drifting, but any one who has visited

the spruce forests on the east slope of the Front Range in winter or spring could hardly agree to its local application. Figure 2, taken in the first week of July, 1912, shows conditions that were characteristic in the upper forest belt. It certainly does not indicate a uniform depth of snow as the typical form of deposit in the spruce forests of this region. This photograph is presented to bring out the fact that in a region of this kind large drifts do occur in the timber not only occasionally, but as the characteristic form of deposit.

The trees appear to act as wind-breaks and cause the snow to be deposited and held in the pockets and glades instead of being carried down

FIG. 3.—*Looking southeast from Mt. Audubon*
Taken July 6, 1912

to lower altitudes. The wind-break action of the stunted trees near the timber-line is clearly shown in figure 3, taken in July.

So far as the retention of snow is concerned, there is probably little difference of opinion that the highest altitudes offer the least opportunity for the early melting of the snow due to the influence of rain and the temperature of the air.

A consideration of the various factors that affect the snow reservoirs brings out the reason why the catch-basins lying above timber-line are superior in every respect for the formation and retention of large snow-

drifts. Their advantage is due not to the fact that it is treeless, but to is location in regard to precipitation, wind, and summer climate. It is not just (as is sometimes done) to cite the areas above timber-line which retain the snow late in the summer as arguments in support of the contention that treeless areas are better fitted for this purpose than timbered ones. Comparisons of this sort, it is rather unnecessary to say, can be of value only when the sites are comparable in respect to climate. It would be comparable and equally unreasonable to cite the treeless plains at the base of the mountains and in a region of small snowfall as examples of areas which do not retain a late supply of snow because they are not forested. If it were possible to extend the wind-break type of forest to the areas above the present timber-line that are now swept bare of snow, that

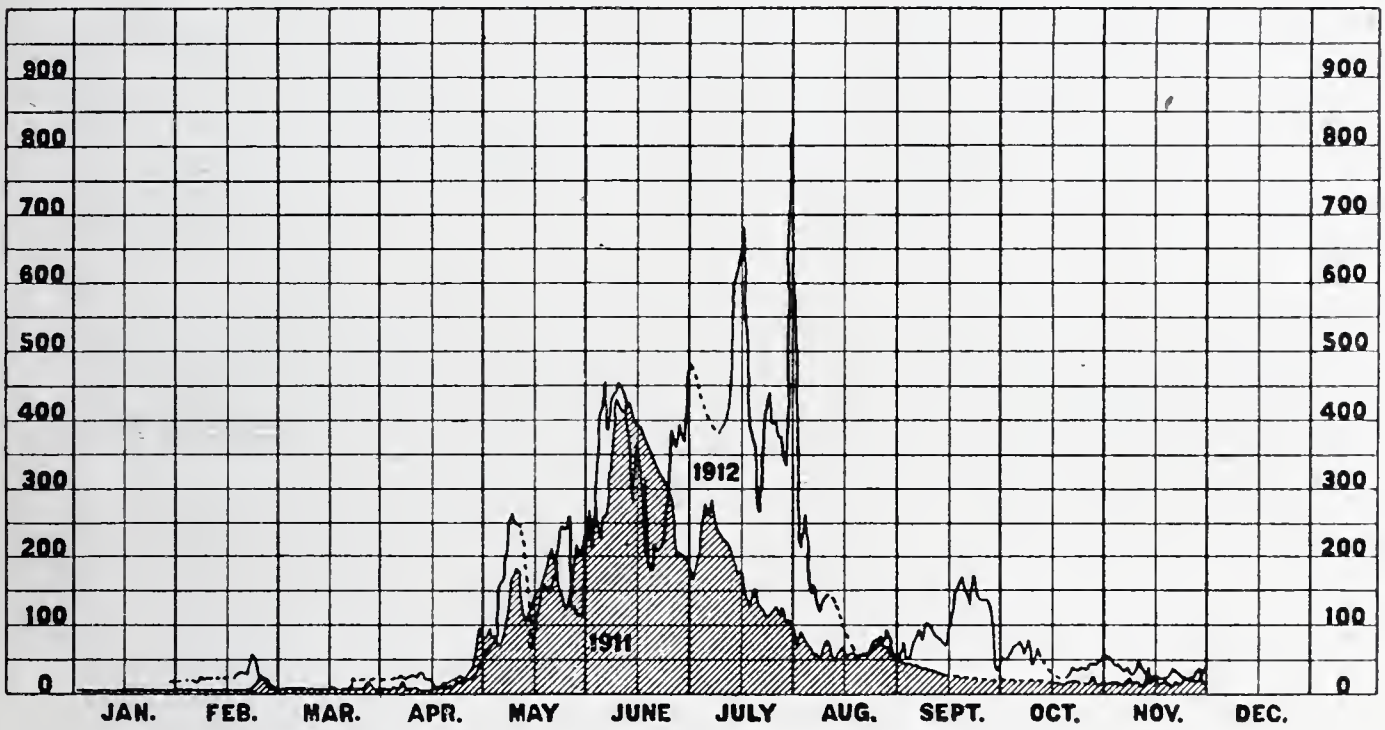

FIG. 4.—*Discharge of Boulder Creek at Orodell, 1911 and 1912*
Drainage area = 108 square miles

region would be still more important as a reservoir for the summer stream-flow. The part that the present stands of spruce play in keeping the snow as high as possible is the important point, and has a direct bearing on the value of reforesting the many burned areas in the high mountains at the head of streams.

Just how much influence on the amount of stream-flow the melting snow of the forest region has is, of course, the final measure of the importance of the whole question. No data at hand will show this proportion, though it is certain that in summer nearly all the flow comes from the upper belt of forest and the adjoining areas above timber-line. Any factor that could change the disposition of considerable amounts of snow must, therefore, be of importance in regard to the time at which it ultimately reaches the stream.

In order to show the type of flow in a mountain stream largely dependent for its supply on a region whose precipitation is chiefly snow, figure 4 is presented. It shows the discharge[2] of Boulder Creek at Orodell, a station near the plains, for the years 1911 and 1912. The sources of Boulder Creek lie in the region between Corona and Mt. Audubon, near which the accompanying photographs were taken. The marked difference in the two hydrographs is apparently due to two causes—one a larger precipitation in the winter of 1911 to 1912 than occurred in the winter of 1910 to 1911,[3] and the other the later spring of 1912, which delayed considerably the time at which the snow melted in the upper mountains.

The hydrographs bring out the difference in flow that takes place when for any reason a supply of snow is retained later in the year. In this case the cause of the later retention of snow lies in climatic conditions; but it is not unreasonable to believe that if other causes also affect snow retention, the same type of hydrograph would result from their operation—that is to say, that if more snow could be held in protected drifts in the head-water areas, under similar climatic conditions, the result would be an appreciably larger summer flow.

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[2] Data for the hydrographs were taken from the Sixteenth Biennial Report, State Engineer, Colorado.

[3] From October, 1910, to June, 1911, inclusive, precipitation at Corona was 35.4 inches; from October, 1911, to June, 1912, inclusive, precipitation was 46.7 inches.

CHEMISTRY AS AN AID IN THE IDENTIFICATION OF SPECIES

By A. W. Schorger

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Botanical identification is based largely upon morphology, about which are grouped various characteristics of plants that permit of their separation into species. The parts of many plants are susceptible to change in form under different conditions of climate, soil, and other factors. As a result, new species or varieties are described for reasons that might not appear basically sound in other branches of science. On the other hand, certain species could not be well differentiated by the botanist using the ordinary methods of approach, while to the chemist there might be a sharp distinction.

Failure to employ chemical means of identification more extensively may be due largely to the comparatively recent entrance of chemistry into this field. At the time that Linnæus (1753) was devising his rational system of classification and nomenclature, chemists were still laboring under the utterly erroneous phlogistin theory. In the case of plant chemistry, especially, great advances have been made only during the past twenty-five years. The progress in this domain has been of great assistance to the botanist, and with time much may be anticipated. With sufficient data at his disposal, it would be as logical for the chemist to form a rational system of botany along chemical lines as the botanist has effected on form and structure.

The objection has been raised that the primary as well as the secondary products of plant growth may undergo considerable changes, both qualitatively and quantitatively, under different conditions of growth, while little change could be noted from a botanical standpoint. This is true in part. Several examples could be cited of the same plants producing very different volatile oils in different localities. The lavender plant (*Lavendula vera*), indigenous to France, gives in the latter country an oil containing 40 to 42 per cent of esters. In England, however, where this same species has been cultivated for many years, the ester content of the oil never exceeds 10 per cent. The fennel oil produced in Saxony, Galicia, and Moravia contains fenchone, while this constituent appears to be entirely wanting in the Macedonian product. Of interest

in this connection are the observations of Clover[1] and Bacon[2] on the oils from Philippine elemi. Investigations of the oils distilled from numerous samples of resin collected from individual trees showed that some consisted either of pure terpinene, limonene, or phellandrene. All the botanical material, however, was referred by Merrill to *Canarium luzonicum* A. Gray.

Variations such as the above may throw doubt on the validity of a determination of species by chemical analysis, but it has nevertheless become a well-defined general principle that the composition of an oil may vary quantitatively as regards the individual constituents, but rarely qualitatively.[3]

The extensive work on Australian eucalypts[4] by Baker and Smith offers an example of the potential value of combining chemical analyses with botanical investigations. The following extract from their publication may become more generally acceptable as science progresses: "The theory has often been advanced that the chemical constituents of the same species vary in different localities, but this is not verified by our experiences as regards eucalypts, as they do not show those differences in constituents that might perhaps be expected from differences of soil or localities. This may possibly be accounted for by the natural selective peculiarities shown in many instances by the species themselves, as it is remarkable how a certain species will flourish in a particular geological formation and become singular to like formations, while at the same time objecting to those entirely different. However that may be, those influences do not appear to act detrimentally, or to interfere in any way with the practical constancy of results." The oil from the blue gum (*Eucalyptus globulus*) was found to have the same constituents and practically identical properties, regardless of the locality from which the material was obtained. A recent examination[5] of the oil of *Eucalyptus globulus* from California has shown that the constituents present were the same as those found in the Australian oil.

Bourquelot and Fichtenholz[6] have examined the distribution of the glucoside arbutin in the leaves of *Pyrus* species with very interesting results. This glucoside was present in the leaves of *Pyrus communis*. but none could be detected in the leaves of *Cydonia vulgaris* Pers., *Malus communis* Link, *Sorbus aucauparia* L., or *S. torminalis* Crantz, all of

[1] Phil. Journal of Science 2A, 1 (1907).
[2] Phil. Journal of Science 4A, 93 (1909).
[3] Semmler, "Die Aetherischen Oele." Erster Band, s. 15, 1906.
[4] "A Research on the Eucalypts," 1902.
[5] Burke and Scalione, Jour. Ind. and Eng. Chem., Vol. 7, p. 206, 1915.
[6] Jour. de Pharm. et de Chim. (VII), Vol. 3, p. 5, 1911.

which were formerly classed under *Pyrus*. In this case the revised botanical classification is fully supported by phytochemical data. Some American botanists still refer *Sorbus americana* Marsh to *Pyrus*, while others apologetically place it under the genus *Sorbus*.

Attention[7] has previously been called to the part that chemistry has played in the identification of several Californian pines. It was found to be difficult in the field to distinguish between Jeffrey pine, western yellow pine, and "cross variety" pine, the latter apparently grading imperceptibly from typical western yellow pine into Jeffrey pine. Botanical material as well as oleoresins were collected from the three forms for identification. The examination of the volatile oils from these species offers, in my opinion, a very clear case in which chemistry has been able to show a sharp distinction between species on which dendrologists have not agreed. Sargent[8] considers the Jeffrey pine a variety of western yellow pine (*Pinus ponderosa*), yet the oils from their respective oleoresins are entirely different. Some authors have included all western yellow pine under *P. ponderosa*. The separation of the stands occurring in New Mexico, Arizona, and Colorado into a variety (*P. ponderosa scopulorum*) would seem fully justified, since the oils from *P. ponderosa* and its variety are entirely different. Mr. Sudworth has recently combined *P. ponderosa scopulorum* with *P. ponderosa*. In view of the fact that there must be some morphological distinctions between the two forms to have warranted the initial separation, and since the oils are distinctly different, it would seem that *P. ponderosa scopulorum* should be retained.

Five individual trees of each "species" were tapped and the oil obtained from the oleoresin of each was examined separately. In Table 1 are included analyses of the oils from Jeffrey pine, "typical" western yellow pine, "cross variety" western yellow pine, "bastard" pine (apparently to be included in the same class as "cross variety" western yellow pine), and *Pinus ponderosa scopulorum*.

It will be noted that the oils from the Jeffrey pine are very uniform in properties, the specific gravity and refractive indices being entirely different from those of the remaining oils. Chemically the Jeffrey pine oils contained at least 95 per cent of heptane, a hydrocarbon differing widely from the terpenes of which the remaining oils consist. The low specific gravity and boiling point of heptane permit a ready identification and separation from the terpenes. None of the ordinary terpenes boil below 156 degrees centigrade, while heptane boils at about 98 de-

[7] C. S. Smith: "Turpentine Possibilities on the Pacific Coast." W. H. Lamb: "Discussion." Proc. Soc. Am. Foresters, Vol. IX, pp. 327-341, 1914.

[8] Manual of the Trees of North America, 1905.

TABLE 1

Species.	Sample No.	Specific gravity.	Refractive index.	Optical rotation.	Approximate initial boiling point.	Heptane present.	Terpenes present.	Principal constitue
		15°	15°		Degrees			
Jeffrey pine (*P. jeffreyi*) (Calif.)...	1	0.7013	1.3963	.....	98	Yes	No	Heptane, about 95 per cent.
Do.....	2	0.7018	1.3958	.....	.....	"	"	
Do.....	3	0.6951	1.3927	.....	.....	"	"	
Do.....	4	0.7110	1.4002	.....	.....	"	"	
Do.....	5	0.7008	1.4060	.....	.....	"	"	
Typical western yellow pine (*P. ponderosa*) (Calif.).....	1	0.8688	1.4793	—21.23°	164	No	Yes	Beta-pinene, about 65 per cent.
Do.....	2	0.8640	1.4785	—17.12	.....	"	"	
Do.....	3	0.8643	1.4780	—15.73	.....	"	"	
Do.....	4	0.8659	1.4790	—19.45	.....	"	"	
Do.....	5	0.8653	1.4783	—26.52	.....	"	"	
"Cross variety" western yellow pine (Calif.).....	1	0.8657	1.4773	—12.63	165	"	"	Beta-pinene.
Do.....	2	0.8610	1.4770	—27.14	.....	"	"	
Do.....	3	0.8589	1.4765	—18.44	.....	"	"	
Do.....	4	0.8663	1.4777	—33.93	.....	"	"	
Do.....	5	0.8500	1.4765	—67.37	.....	"	"	Limonene.
"Bastard" pine (Calif.).....	—	0.8660	1.4724	+30.33	156	"	"	Alpha-pinene, about 65 per cent.
Western yellow pine (*P. ponderosa scopulorum*) (Arizona).....	1	0.8654	1.4723	+13.03	157	"	"	
Do.....	2	0.8672	1.4729	+12.86	.....	"	"	

grees centigrade. This wide difference in boiling points permits the easy separation of heptane from the terpenes, even when heptane is present in comparatively small amounts.

The oils of the "typical" western yellow pine are very uniform, and no heptane is present. In the case of the "cross variety" oils also no heptane could be detected. They consisted entirely of terpenes. These facts should be conclusive that Jeffrey pine is a sharply distinct species and that no intergradation with the western yellow pines exists. The interesting fact appears that the properties of the "cross variety" series of oils are by no means as uniform as those of the "typical" western yellow pine, sample number 5 especially showing an unusually low specific gravity and a high optical rotation. Examination showed that this oil consisted almost entirely of limonene, which is present to the extent of about 20 per cent in all oils from western yellow pine. There is accordingly, in the case of the "cross variety" pines, a lack of uniformity in the oils as well as in the botanical features of the trees. No question can arise, however, as to its close relation to the typical western yellow pine.

About a year before the examination of the three series of oils was made a sample of "bastard" pine oleoresin was submitted from California to determine if the oil agreed with that of western yellow pine or Jeffrey pine. "Bastard" pine is evidently a synonym for "cross variety" western yellow pine. The oil was carefully examined, and found to be practically identical with the oil from *Pinus ponderosa scopulorum* in specific gravity, refractive index, and composition. In the table data are given for the oils of *Pinus ponderosa scopulorum* from Arizona. It should be noted that the "bastard" pine oil and the oils of *P. ponderosa scopulorum* are decidedly dextro-rotatory, while the oils of *P. ponderosa* are decidedly lævo-rotatory. This surprising anomaly led to the belief that in California trees could be found representing typical *P. ponderosa scopulorum* as well as typical *P. ponderosa*. Further examination of oils from individual trees should show some very interesting results that would either substantiate or refute this assumption.

The question may arise as to the ability to distinguish sharply between the oil of *P. ponderosa* and *P. ponderosa scopulorum*. As mentioned above, the oil from the former species is lævo-rotatory. In addition, the percentage composition of the two oils is entirely different. Both oils contain alpha-pinene, beta-pinene, and limonene. However, the oil of *P. ponderosa* consists mainly of beta-pinene, while the oil of *P. ponderosa scopulorum* contains so small an amount of beta-pinene that its detection is exceedingly difficult. On the other hand, the oil of *P. ponderosa* contains only a small amount of alpha-pinene, while the oil of *P. penderosa*

scopulorum consists mainly of this terpene. The difference between the two oils is pronounced. Oils from western yellow pine from Arizona and Colorado agree entirely, while oils examined from the State of Washington agree with the typical oils from *P. ponderosa* of California, showing that the defined difference in geographical distribution of the species and its variety is supported by a difference in the composition of the oils.

The results obtained chemically and those obtained botanically by Mr. Lamb agree with one exception. This exception occurs in the case of Jeffrey pine material collected as such, but referred to *P. ponderosa* from an examination of the internal structure of the leaf and the shape of the cone scale. The validity of this exception should have been checked by a re-examination, both chemically and botanically, of fresh material from this particular tree, since, based on a chemical examination, the exception must be referred to *P. jeffreyi*, thus leaving uncertain the diagnostic value of the botanical methods employed.

The statement was made by Mr. Lamb that digger pine and the firs also produce heptane. So far as the author is aware, *P. jeffreyi* and *P. sabiniana* are the only conifers that produce this hydrocarbon. Mention is also made of the occurrence of a thin-walled layer of cells next to the epidermis of the leaves of *P. ponderosa*, while in the case of the species producing heptane, *P. jeffreyi* and *P. sabiniana*, this layer of thin-walled cells is absent. From these facts the probability was assumed of a difference in the phytochemical processes taking place in the leaves, the trees having the thin-walled layer of cells in the leaves producing terpenes in the wood, the trees in which this thin-walled layer of cells was absent in the leaves producing heptane in the wood. If it is assumed that the formation of heptane takes place within or is closely related to the phytochemistry of the leaves, this assumption is apparently incorrect. Oil[9] distilled from the needles and twigs of digger pine (*P. sabiniana*) were recently examined by the author, and found to contain only 3 per cent of heptane, the remainder consisting of *terpenes*. The source of this small amount of heptane may safely be referred to the oleoresin occurring in the woody portion of the twigs present in the distillation material. Tschirch and Faber[10] have shown that the oleoresin of conifers is formed in the first layers of new wood. This observation, combined with the results given above, indicates that the phytochemical processes taking place in the needles and in the wood are distinct and separate.

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[9] Jour. Ind. and Eng. Chem., Vol. 7, p. 24, 1915.
[10] Archiv. d. Pharm., Vol. 239, p. 249, 1901.

SUMMARY

The data obtained by chemical analyses have shown that "cross variety" western yellow pine should be referred to *P. ponderosa* and that there is no relation between "cross variety" pine and *P. jeffreyi.*

There are also indications of the occurrence in California of typical specimens of *P. ponderosa scopulorum.*

The oils from *P. ponderosa* and *P. ponderosa scopulorum* are distinctly different and justify the separation into two forms. Oils from western yellow pine from Arizona and Colorado agree closely, while oils examined from the State of Washington agree with the typical oils from *P. ponderosa* of California, showing that the defined difference in geographical distribution of the species and its variety is supported by a difference in the composition of the oils.

FORESTERS HAVE A VITAL INTEREST IN THE WHITE-PINE BLISTER RUST

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Forestry deals with long-term investments commonly of very considerable magnitude, which depend for profits solely on the anticipated rate of development of trees for a period of 50 to 200 years after the forestry operations are begun. The forester then must be very sure of the correctness of his calculations and of the premises upon which they depend. Especially must he be certain that he is choosing the best tree species for his purpose when he undertakes replanting operations or any other intensive system of management upon the success of which his future forest crop depends.

In spite of the great progress that has been made, we are only beginning to practice true forestry. Now is the worst possible time for serious errors in judgment to be made. Until about 10 years ago the chestnut and the white pine were the two species used in the Northeastern States as a basis for our future forests. The former because of its rapid growth and ability to reproduce by sprouts, and the latter because of its rapid growth, adaptibility to nearly all sorts of situations, high value, and freedom from the attacks of the gypsy moth, were especially depended upon to form the future forest.

This forestry program of the Northeastern States has been seriously upset by the chestnut blight—a parasitic disease imported from China within the last twenty years (1, 2). This fungous parasite has invaded the range of our native chestnut to its northern boundary and as far south as North Carolina and West Virginia. Apparently it will exterminate the chestnut as a forest tree. No forester is today depending on chestnut for a future crop, while those who recently refused to believe their own eyes are now realizing that this disease must be reckoned with, whether or not this suits their plans. As far as the forester is concerned, the chestnut is out of the question for future operations.

The forestry program mentioned above is now liable to be finally and completely upset because our white pine is very seriously threatened by another imported fungous parasite, known as the white-pine blister rust (*Cronartium ribicola*). Six years ago the white-pine blister rust was found to have been introduced into this country upon several millions of

young white-pine seedlings imported from a German nursery. It has since been found that scattering shipments of *Pinus strobus* had been received from nurseries in Holland, England, and France which also were infected with this disease. Some of these entered this country as much as 10 or 12 years ago. Since its first discovery here, at least 23 distinct outbreaks of the disease have occurred in various parts of North America, which demonstrates beyond question that this fungus is capable of becoming an aggressive forest parasite of our white pine. What is here called an outbreak is a case where the disease transfers from the originally infected white pines to currants and gooseberries (Ribes) in the vicinity. In eight of these cases it has passed back from the Ribes to neighboring white pines and in two cases to native trees in near-by woods. The chain of evidence is absolutely complete and without flaw, showing that this disease can and will spread here in North America, and this is true not only in a single locality, but in widely separated ones with considerably different climates. In any one of these outbreaks it might become permanently established here. The danger of this has become much more acute this year than ever before.

The only condition necessary for the progress of the disease is that some species of Ribes shall be within a few hundred feet of the affected pine. So far as we may now judge from information obtained by artificial inoculations and from observations in the field, practically every species of Ribes is susceptible and may spread the disease. Actual tests show that wild species of Ribes of the Pacific coast and Middle West are susceptible, as are also the species of the New England States. The American five-leaved pines—*Pinus strobus, P. lambertiana, P. monticola,* and *P. flexilis*—are known to take this disease in Europe, while there is every reason to expect that all our other five-leaved pines will prove to be susceptible also. There is grave danger that this disease will yet reach the Pacific Coast or Rocky Mountain regions, and it is certain to do so if it is not soon eradicated in the East.

Some foresters doubt the seriousness of this disease just as they did in the case of the chestnut blight. This disease has not yet been present in this country long enough to show what it really may do. The white-pine blister rust is a rather slow-working disease in the older trees which it attacks (3), and, in the writer's opinion, an outbreak of it in this country will not show fully what may occur until 20 or more years after infection occurs. This is a much longer period than has yet elapsed since its introduction into North America in large quantities.

Ritzema Bos (4: 21, 69), in 1901, stated that this disease is so prevalent in Holland that the culture of white pine is impossible.

W. G. Smith (4: 18, 67), in 1898, said it became so serious in a large commercial nursery of Germany that the entire stock of white pine had to be destroyed and the culture of the species given up.

Hisinger (4: 18), in 1876, tells of white pines 30 years old being killed by it in Finland. Destructive outbreaks of this disease in the forests of Europe are described by Nordstedt, Brick, Ewert, Tubeuf, Griffon and Maublanc (4: 16-20), and Visart and Bommer (5).

Fron (6) states that many nurserymen have had to give up the growing of the white pine because of this trouble.

Ravn (3, 4: 18), the leading plant pathologist of Denmark, says that the white pine would be very successful in Denmark were it not for this disease. But it is so prevalent and destructive that the white pine is no longer used there as a forest tree. Lind (7), in 1913, says of the condition in Denmark:

"Has spread very widely and is doing great injury both to Pinus and Ribes; the cult. of *Pinus strobus* has in several places been quite abandoned on account of this fungus. It is so common that it would take too much time to state all its localities. * * * Rostrup has noticed hundreds of trees killed by this fungus."

The white-pine blister rust was first found in Great Britain in 1892. In 1909 Somerville (4: 18) says of it there:

"This disease is so much on the increase that it is not too much to say that the outlook in this country for the Weymouth (white) and other five-leaved American pines is almost hopeless. * * * But it is to be feared that the day is not far distant when it will gain a footing in North America, and if it spreads there, as it has done in Europe, the loss that will result through the destruction of one of America's most valuable lumber trees can only be described as appalling. On the Weymouth and similar pines, on the other hand, it is so fatal that there are estates in Britain (*e. g.,* Murthly in Perthshire and Woburn in Bedfordshire) where hardly a living example of *P. strobus* or *P. monticola* is left, at least of the younger classes.

"It is not pleasant to have to give this opinion, but any one who has seen the conditions of things on the estates mentioned or in the Crown woods near Windsor and Ascot must realize how hopeless is the future of the Weymouth pine in this country."

We therefore have the state of affairs described by Somerville, developing in England in about 20 years. Watson (11), in 1912, confirms Somerville's statement in the following words:

"The Weymouth pine suffers here (Woburn), as in all parts of the country, from the fungous disease *Cronartium ribicola,* which prohibits its use as a forest tree in this country, and has lately commenced to be destructive in the United States."

Laurie, in 1898, described trees of *Pinus monticola* in England, up to 60 feet in height, which were attacked by this disease. And Somerville (8), in 1914, stated that *Pinus monticola* suffers in Europe even more than does *P. strobus* from the blister rust.

The occurrence of this disease in native pines in an American locality has been described by the writer (9 : 2-3). Here one-third of the total number of trees were attacked and over one-sixth so injured that it would have been a matter of but a few years before their death. Had not the trees been quite isolated from the surrounding forests the damage would have been much more extensive.

The writer is not alone in believing North America is in great danger from this disease. Somerville has already been cited. Tubeuf, of Germany (10), has said that our quarantine against five-leaved pines is well done because of our peculiar danger from it; also that the danger to our western pines is real. Moreover, the American Phytopathological Society, the official society of American plant pathologists, passed the following resolution, in 1909, concerning this and another newly introduced plant disease:

"*Resolved,* That the American Phytopathological Society views with alarm the recent introduction into America of two dangerous European plant diseases: the potato wart, caused by *Chrysophlyctis endobiotica* Schilb., and the blister rust of white pine, caused by *Peridermium strobi* Klebahn. The former has been discovered in Newfoundland. The latter has been widely distributed in nine of the United States and in the Province of Ontario, but is now believed to have been eradicated.

"*Resolved,* That the society deplores the fact that in the absence of any national regulation in either the United States or Canada both governments are powerless to prevent the continued introduction of these and other dangerous diseases, or their transference from one country to the other.

"*Resolved,* That on account of the enormous financial interests involved in potato culture and in white-pine reforestation, this society regards the situation as very alarming, and one which warrants radical and immediate action. Even if these diseases do no more harm in America than they have in Europe, the situation is serious; but every law of biology and all experiences with plant diseases and pests indicate that, in a new climate, with new varietal and specific hosts and with an entire continent in which to spread, both diseases will reach a degree of virulence unknown in Europe; therefore

"*Resolved,* That this society pledges its support to all legislation in both the United States and Canada looking toward the inspection, quarantine, or prohibition from entry, as may be necessary, of all plant material liable to introduce these or other dangerous diseases or pests."

It is clear that our future forestry of the Northeast cannot be based safely on the white pine unless this tree can be freed from the danger of

the white-pine blister rust. The situation with the white pine is quite similar to that of the chestnut when the chestnut blight began to attract attention, in 1905 to 1909. Then the danger from this imported disease was not generally recognized, in spite of repeated warnings, but its subsequent development speaks for itself. It is true that with the chestnut we have the first instance known in the world of an important forest tree being exterminated commercially over a large area by a fungous parasite. But it must not be taken for granted that other cases of a similar nature cannot occur. Indeed, we have with the white pine all the conditions necessary for this very thing to happen. These conditions are:

1. An imported disease already known to be serious upon our white pines in Europe, the region from which we receive it.
2. Wide distribution of this disease in North America.
3. Its known ability to become an aggressive parasite here.
4. Abundant and wide distribution of its alternate hosts (Ribes) wherever five-leaved pines occur.
5. Known susceptibility of practically all these alternate hosts and of our three most important white pines, whose combined ranges cover most of the pine forests of this country except the so-called "southern" pine area.

These conditions occurring simultaneously can mean nothing but danger, and very grave danger, to our white pines.

The western five-leaved pines are very gravely endangered, even with the situation as it now is. If the disease becomes permanently established in the East, it will be a mere matter of time for it to reach the western forests. Wild species of currants and gooseberries are common in those forests, and the tests already made show that they are susceptible to the disease. *Pinus lambertiana,* known to be quite susceptible to this disease, is one of the most important timber trees of the Pacific Coast region, while *P. monticola,* an important timber tree locally in the northern Rocky Mountain region, is also known to be quite susceptible. What this disease may mean to the West the forester who knows the forests of that region can best realize. These pines are the very foundation of much of the local industry of their sections.

Foresters have a very real concern in this disease and in its eradication from this continent. The Federal quarantine against importation of young pines has effectively closed the doors against our receiving any more of this disease. It remains for us to get rid of what we have.

The writer believes that the only way to accomplish this is by the total destruction of each lot of trees in which this disease is definitely found. Repeated annual inspection will not result in weeding out the affected

trees, for it has been discovered that the disease may hold over in an affected tree for a number of years before becoming visible. How many years it may thus hold over we do not at present know. Ravn (3) has recently stated that it apparently may do so for 15 or 20 years. With the repeated inspection method, the constant danger exists that the disease may escape, attack Ribes somewhere in the vicinity, and originate a serious outbreak of the disease which may spread to native trees.

If the forester is not willing to give up in his plans for the future forest the white pine together with the chestnut, he must take a hand in the eradication of this disease wherever he may find it and in every possible way. He must be not merely a passive spectator, but a very aggressive factor in the fight. What, then, can the forester do to help in this fight? He may:

1. Destroy diseased lots of trees himself.

The foresters of New York, Vermont, and New Jersey have already done this or persuaded owners to do so themselves.

2. Collect information concerning plantings of white pine which may have been imported.

The forester ought to have all such information in his regular work, and is in a better position to obtain it than is any other person. If the forester is not doing the eradication work himself, he should give this information to the officer who is doing it.

3. Develop public sentiment in favor of the eradication work. This is absolutely necessary for its success.

The forester is in the best position to do this in connection with his work with private individuals and corporations, and can do it effectively and naturally whenever the question of white pine comes up. If no State officer is efficiently handling the eradication work, the forester should do his best to have efficient work done.

4. Make it known that he favors the eradication work and is actively backing it.

This public stand should be taken whether or not the forester has any of the disease within his State or locality. The opinion of foresters who are not immediately concerned is valuable and very helpful.

5. Aid in every possible way the securing of complete power for the proper State official to eradicate this disease by the destruction of pines or Ribes, or both if necessary, with or without the consent of owners.

Unanimity of action is absolutely necessary in order to get rid of this or any other fungous disease. This is especially true concerning action within each State, and is but slightly less necessary between the different States concerned. The forester might be able to aid in such eradication

of pines if he could be empowered to give the owner a suitable number of young pines of another species to replant the vacant ground. Offers of this kind are said to have been already made by some State foresters.

The forester who fails to support the work of ridding American forestry of this impending danger is really working directly against the interests of our future forests. Whether the forester undertakes to aid in the total eradication of the disease from North America or not, if he remains a forester he cannot avoid considering this disease in the future as a routine matter in all his operations dealing with the white pines.

The present situation is such that if the white pine is to be seriously considered in the future as the basic species in our forestry, everybody at all interested in it must realize the crisis confronting them and act immediately. Certain large areas are so infected that either the pines or the Ribes must go. In order to do this work, the proper State officials must be given absolute authority to act as may be necessary to stop the spread of the disease and to finally entirely eradicate it. If this cannot be accomplished, the past work of the northeastern foresters will have been largely done for nought. The immediate loss occasioned by this work will be infinitesimal compared to that caused by the discouragement of replanting, the crippling of the nursery industry, and the loss of interest in forestry which will finally result from the disease if allowed to permanently establish itself here.

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THE AMERICAN FORESTER: HIS OPPORTUNITIES

By Coert DuBois, District Forester

Delivered at the San Francisco Meeting, October 18, 1915

To my mind, this subject is too big, too broad, and too deep to permit a discussion of what the chances are today for young men desiring to enter the profession or of the amount of money the practicing forester may make. Opportunities viewed broadly immediately turn into responsibilities. Each one is a chance to do good or to do evil. Each, as it occurs, immediately sets up a responsibility to take the opportunity for good or pass up the opportunity for evil. If I were in your place I should be thinking now, "Has that kid the nerve to try and preach a sermon to me?"

That's just it. It seemed to me that the opportunity to talk on this subject entailed the distinct responsibility of presenting, in the strongest words I could muster, the responsibilities of the American forester at the present stage of the American game. Having tried to get out of it, and failed, I'm going to hand it to you straight, as I see it.

Sometimes in thick timber it is difficult to rid oneself of the impression that the forest has no end to it. There are foresters whose vision sticks in the woods and does not pierce through to the fact that the welfare of people, not the welfare of a community of trees, must be the aim of the forester's endeavor. Forests are only the medium through which he works. The most successful forester is the one whose life and work contributes most fully to the necessity, convenience, and pleasure of the greatest number of people—not necessarily the one who grows the most wood per acre in the shortest time.

Now, let's restate this proposition something like this: The American forester; what are his chances to help toward a higher standard of American citizenship, and what is he doing about it? Wherever his work presents a feature peculiar to the profession, there is a good place to look for a trail which may lead to an opportunity for the forester to contribute toward this end.

If you were handed a strange tool, you would examine it critically to see what peculiar points it presented, and these would probably suggest to your mind its particular field of usefulness. The forester's training and work and the sort of a life he leads inevitably tend to develop in

him certain qualities which are characteristic of the profession. Take a group of forest rangers, for instance: They have so many characteristics in common that we speak of the "ranger type."

Training in topographic mapping, the study of the physical features of a region, and timber reconnaissance develop not only the intimate knowledge of many specific bits of the geography of this country in all of us, but it also develops a peculiar faculty of learning new country quickly—of unconsciously carrying in our heads the details of the locality we are traveling, and piecing it together until, when we come out, we have a concrete idea of the topographic whole. Handling planting, reconnaissance, construction, or other crews of men on forest work develops in us the quality of leadership—the ability "to handle men." Planning forest work and determining the functions of the units of the forest force teaches us the value of discipline and co-ordinated action. Fire fighting makes us think quickly and accurately in the face of a shifting and indeterminate and often dangerous force, and by repeated mistakes trains us in the right way to transport, subsist, distribute, and control large numbers of men. Carrying on our work far from the responsible head makes us self-reliant, able to depend on our own ingenuity and resources, and at the same time puts us on our honor to be dependable and trustworthy.

Now, if every good forester of well-rounded experience has, in a greater or less degree, these qualities: the faculty of learning quickly new regions, the ability to handle men, the power to think and act in emergencies, the faculty of subordination to authority and of maintaining discipline, and of self-reliance, where is the biggest field in which it might become necessary to put them to work? The answer is obvious—national defense. Have you ever asked yourselves seriously exactly what you would do if you were suddenly confronted with the sort of billboards the young men of Europe must read everywhere: "Your President and your country need you"? Do you possess these qualities in just the shape where they could be made to deliver the greatest usefulness in the event they were needed by the President and the country? You do not. You possess them in the raw. You might ask yourselves what you are doing to refine them. Here is a forester's opportunity, which is at the same time a tremendous responsibility.

Our work takes us into the back waters of American civilization. We have a chance—an opportunity, if you like—to see and study and know the conditions under which the dwellers-on-the-edge live. And if the forests under our care are to contribute to the public welfare, is it not

fair to say that they should, wherever we can make them, first contribute concretely to the welfare of the local forest communities, and then, through the utilization of forest products, to the general welfare of the general public? What, in the forest, can be of the most use to these people? Answer, the forester.

You all know the North Carolina mountaineer. You know his illiteracy, his archaic agricultural methods, his narrow outlook, his hopelessness and poverty. What made him so was, first of all, his isolation; then his lack of educational communication and transportation facilities. Every backwoods district presents some of the same conditions, and the people living in them some of the same characteristics. The forester who regards his forest dwellers with amused curiosity—like the hitherto unknown species of toad—is a misser of opportunities who should be sharply spoken to. If he is the right sort of a forester and, above all, if at same time during his career he has lived and worked alone, he will probably regard them with a deep and sympathetic interest. He will try to learn their language and to see things with their eyes, and he will consider himself privileged if eventually he gains their confidence. When he has done so, a long vista of opportunity is open to him.

He can fire the imagination of the sons of these people and awaken in them a desire for education. He can introduce books. He can salve, and often heal, local feuds—quarrels. He can awaken a desire for better communication and gently steer the co-operative action necessary to get it. He can carry news of modern conveniences that will ease the load of the overworked farm women. With his knowledge of growing things and soil productivity he can often help in questions of farm management. And if he does not know the answer to such questions, he at least knows the channels through which they can be found out. Part of the training of every forester should be a course in chewing tobacco and whittling and sitting on corral fences in order to fit him for the responsible task of the after-supper talk with the great American nestor.

It is a great thing to make two trees grow where but one grew before. It is a much greater thing to have made it possible, by the work of your brain and back and legs, for one man to earn a decent living for himself and his family where no man did before.

The process of the conversion of a natural resource into a product of necessity or convenience or food produces wealth, and its distribution among the people who contribute to its production makes new opportunities for decent livings for their families. Whenever the thought and effort of any one of us results in the investment of capital in a plant to

manufacture forest products—an investment which would not have been made without that thought and effort—that forester may be credited possibly with helping to secure for the sick baby of the head bookkeeper of a company manufacturing steam logging equipment the expert medical advice necessary to save its life.

That sounds rather far-fetched, doesn't it? The process is called measuring values in terms of humanities. Try it some time. It's good mental exercise.

PROFESSIONAL ETHICS

By Dr. B. E. Fernow

Dean of the School of Forestry, University of Toronto

Delivered at the San Francisco Meeting, October 18, 1915

Last year, when I had the honor to preside over a meeting of the Society at Ithaca, I made some remarks on the duty of the Society of standardizing the practices of its members, including the moral conduct or the ethics of the profession. Your program committee has asked me to enlarge upon this latter topic at the present occasion.

Using the words of Lord Bacon, "I hold every man a debtor to his profession; from the which as men do seek to receive countenance and profit, so ought they of duty to endeavor themselves by way of amends to be a help and ornament thereunto." This sense of obligation to uphold the standard of the profession should animate at least every member of the Society, if not every member of the profession.

The fact that we are still a young, perhaps the youngest, profession in the New World which asks for public recognition and is under critical public observation, merely accentuates the necessity of insisting on a strict and high standard of ethical conduct; and, while our relations to our employers or clients are not as personal or intimate as those of physicians, lawyers, and pastors, it is nevertheless incumbent on us to be as faithful to their interests and maintain as honorable relations. Because of its youth and the relatively small number of members, more complex questions of ethics have perhaps so far not frequently arisen in our profession. We could afford to let them be settled without consulting associated opinion. But as we grow in numbers and relationships become more complicated, greater watchfulness will be needed, more difficult application of the principles of equitable conduct will be experienced, and a certain solidarity of interest in their application will have to be established.

This summer, on an inspection trip through the Canadian forest reserves, I was struck more than ever with the fact that knowledge, and even intellect, are of less moment in the personnel that administers these properties than the moral qualities—zeal, devotion to duty, fidelity, reliability, loyalty. The forester in the woods, being removed from the sta-

bilizing influence of contact with the pillars of society, must rely upon his own moral stamina to keep him straight.

I am happy to say that so far the spirit which possesses the soul of the majority of our men is all that can be desired; those lacking in proper spirit are in a very small minority, and I believe that the *esprit de corps* which keeps men on a high plane of moral conduct is unusually well developed among foresters generally. It is therefore not for any reason in the status of the morals in our profession that I have undertaken this discussion, but rather to keep us on the high plane on which we are.

One might be inclined to dispose of the whole question of proper professional conduct by mere reference to the golden rule and decalogue as sufficient guides in the intercourse of men. Of course these two guides should establish the general principles on which conduct should be based; but there arise in practical life problems, conditions, situations, where proper conduct is in doubt. Even in common life the question what constitutes a lie, and whether and when a lie is justifiable, remains in doubt, and in professional relations such problems become more and more frequent.

In other words, there are certain broad principles which never change, which in all ages and in all walks of life have governed the most enlightened and honorable men, the outflow of our moral sense; but there arise in given cases conflicts of principles where there is a choice needed as to which to follow, where most delicate judgment is required to direct our conduct, and there are cases on which authorities of high standing will differ.

No general rule will work in such cases, and each case may present specific modifying conditions which permit a decision one way in one case, the other way in another case. To make clear the character of such cases where proper conduct may become doubtful, I may cite a number of examples which have arisen in other professions as well as in our own or which may in modified form arise with us.

Such cases can be classified into those in which the relation of employer and employed is at issue, and more specifically the relation of expert or adviser and client; secondly, those which involve the relation of the professional man to the general public; and, thirdly, the relation of members to each other and to the Society or whole body of the profession.

Under the first category fall such questions as the following:

Under what circumstances and in what manner may an employee with propriety quit his employer's service?

How far is personal advantage to be sacrificed or to be permitted to outweigh the interests of an employer?

What does loyalty of assistants to superior officers require? What, indeed, are proper relations in official life?

Under what circumstances and in what manner may one employer attempt to persuade an employee to quit another's service? What shall we think about underbidding and overbidding to secure work or to secure employees?

I shall not attempt to answer these questions, for modifying circumstances may force a different choice of conduct in each individual case; but I would point out that the more the personal interests are sunk or subordinated to the interests of the other party, or of the institution, or of professional interests, the higher as a rule will be the ethical plane on which the chooser travels.

The man who recognizes that our work in the world is not to get ahead of others, but to get ahead of ourselves, will usually choose right. He will consider his duties rather than his rewards and supposed rights, and will be in the end most successful because of the loyalty to his work. If the sudden withdrawal of an officer would cripple the service badly, this should be a strong argument for him to stay, even at personal sacrifice. The rule should be that negotiations for a change of position be carried on above board and with knowledge on all sides.

Competition, to be sure, is the rule of the world, and we cannot escape its working; but there is a difference between fair and unfair competition, and it is not always easy to determine where the proprieties are. In more than one case there has been bad blood stirred up by the competition of two institutions for the services of the same men, which could have been avoided if the open, frank way had been used instead of the secret. We are accustomed to look upon loyalty as an attitude of employee to employer, but there is also to be expected loyalty of employer to employed: to secure proper relations, the latter's interest must influence the actions of the former as much as the other way. This is not infrequently forgotten.

Just as the loyal man will be faithful to a superior, even though less capable than himself, the superior, if he is of the right kind, will guard the interests of his subordinate.

Loyalty, faithful allegiance, does not end with superiors and subordinates in office. It is a quality, an attitude which embraces all humanity; it refers to the colleague, to the coworker, to the equal and the less fortunate, and finally to ourselves and to the cause to which we have devoted our lives. The loyal man is loyal all around, and the mutual loyalty which he is able to create gives assurance of his success in life. And when old age comes, and we are passed by those in the race who followed

us, we retain, nevertheless, the honorable place due us in the world in proportion as we are remembered for our loyalty to our cause and to our associates.

This loyal attitude should, of course, also rule in the relations of expert and client.

One of the most common questions which arises in this relation is whether and how far an expert may use the information he secures in the employ of a client to his own advantage or to that of another? How far must he observe secrecy? how far is he in fiduciary position?

While the lawyer and the physician in this respect are limited even by law, the engineer's position in this matter is less defined, and it is generally, although with questionable propriety, contended that whatever knowledge he acquires is his own to use. A somewhat higher standard seems desirable, and as a rule the client should at least be given an opportunity to express himself on this question in any given case. Different cases will vary as regards the propriety of treating information as confidential.

In this category belong also the mooted question whether an employee may secure patents on what he has developed in the business or work of his employer. This, I believe, is now legally settled as far as the United States Government service is concerned.

One of the most mooted and delicate questions is that of an expert's position in court, which combines the questions of relation to client and to the public.

Unfortunately we have not yet secured desirable practice in the employment of experts in court proceedings, where the expert, or several of them, should be in the employ of the court to bring out the truth as fully as possible. As it is, the expert acting on one side or the other in litigation is in the same position as the lawyer, whose business it is to make his client's side appear to be right, or at least to secure a consideration of all alleviating circumstances. He must be partisan.

This raises the question whether the expert may act as a witness unless he is thoroughly convinced of the justice and truth of the case, and whether he may suppress information or opinion hurtful to the case of the client. Of course, no self-respecting man will act on a side which he is convinced is fraudulent or decidedly iniquitous; but in a *bona fide* action, where honest difference of opinion is justified, he may, under the present condition of experts in court, attempt to assist his client to make the best of his case. He is bound, however, in this attempt to tell only truth; but he is not obliged to reveal all the truth, unless forced by the acumen of the defenders on the other side.

To cite a case in point: I acted on the side of the Tennessee Copper Company in the suit brought by the State of Georgia, merely combating the extravagance of the claims of damage against the company. There was no question as to the fact of damage, which was admitted, but the extent could properly be in doubt.

On the other hand, I recall a case where the expert made a written report, bringing favorable argument for his client, but accompanying the report by a letter affirming his disbelief in his own arguments. Such a witness, of course, lacks a perception of professional ethics, and will not be employed by any honest lawyer. Unless the expert has formulated an opinion which he can conscientiously maintain and defend under cross-examination, he has no business to appear as a witness.

Questions of propriety arise often as to the relation of an expert to the enterprise on which he reports.

In the first place, there should be no hesitation in answering in the negative the question whether an expert may undertake work that he is not specially fitted for, and play himself off as an expert where he is not, giving advice which he knows in his own mind is of doubtful value. Nobody ought to pretend to know more than he does. If he does undertake such work, it would at least be incumbent on him to acquaint his employer with his shortcomings in this respect.

There may then be some qualities in the man which may make the employer judge him preferable to another more expert man, but the employer should be given knowledge on which to base his judgment.

In the same category, involving at the same time his relation to the public at large, is the question whether an expert, or one supposed to be expert, may endorse undertakings on which he is not fully informed, and allow his name to be used for advertising purposes.

This is a very common performance, and the public is often humbugged by the respectability of the names of such endorsers. I had the hardest time to escape from endorsing a California eucalyptus venture. The case becomes worse when the professional man has accepted stock or other advantage, and especially a contingent fee for his work based on the success of the enterprise.

While it may not be wrong, it is at least of doubtful propriety for a professional man to invest in a concern for whom he reports. Still less proper would it be for him to invest in something that he knows or expects his client is bound to require in carrying on his business. Individual cases there may arise where there is nothing improper in such investments, but it is dangerous ground, on which to tread with utmost care.

The best rule is to do nothing that you feel afraid or ashamed or unwilling to proclaim openly to the world. How would it look in print? is a question which may stir up conscientious scruples that are lying dormant.

While these problems refer to the relation of the professional man to his employer and to the public at large, solicitude for himself and his fellows and their society raises similar questions.

It is a justifiable ambition to desire one's profession to take an important position before the world, commanding respect and appreciation, and this is secured by the conduct of the individual members of the profession, not only towards the world at large, but towards each other in individual and associated endeavor.

It is a duty at least of every member of the professional Society to take an active interest in its success as a representative of what is best in the profession. Nobody having accepted membership in the Society is justified in withholding his active support in efforts towards increasing its dignity and usefulness.

He owes an obligation akin to patriotism to his profession and to the Society to help make it more efficient, to secure it proper standing. It is not patriotic to merely sit back and criticise; active co-operation is needed and participation in the activities of the Society, contributions to its proceedings and discussions, and, not least, insistence on honorable and ethical conduct on the part of fellow-members. This last is a delicate matter and involves answer to the questions: How far is professional and other criticism of one member by another justified, and what form may such criticism take, and in what animus may it be delivered? What, in general, does professional courtesy mean and require? That the spirit and manner in which such criticism is offered will determine its propriety and its effect goes without saying.

The reverse of criticism is appreciation; and this, too, may be used more frequently than it is to secure professional advancement. This also involves the somewhat personal question, How far may one use the work of others without giving credit? A host of other questions could be asked.

Perhaps it might have been proper to accentuate the fact that a large number, perhaps the largest number, of foresters are and always will be public servants. This fact adds special obligations to deserve the trust placed on them, and, contrary to beliefs in certain quarters, and in spirit of the impersonality of the employer, instead of weakening it, should increase the desire to cultivate and maintain a high standard of professional ethics. There was a time when political influences exercised their

vitiating effect on the efficiency and moral tone of government employees; but this time, I hope, is happily passed; high ideals of public service have been established, and, I venture to say, the U. S. Forest Service has played no unimportant part in bringing this about.

If by enumerating these various problems of professional ethics I have done nothing else than to have stimulated members to reflect on the subject, I shall be satisfied.

I would not advocate, as has been done in other societies, the formulation of a rigid and binding code of professional ethics which the Society would enforce. The fact that so many cases arise which cannot be brought under strict rule, but require delicate judgment on the basis of specific conditions, militates against such a proposition.

Yet I would make the Society a forum before which such questions of ethics may from time to time be brought and discussed. I would go one step farther and suggest a standing honor committee, whose business it should be to bring such matters to discussion; and, more than that, a committee to whom members may refer delicate problems for expression of opinion and advice which might help those who cannot unaided come to right decisions.

Such a committee should be composed of older, experienced members, to whom younger members can look with confidence for right guidance in holding their professonal honor above suspicion.

The mere existence of such a committee would exercise a wholesome influence in checking unprofessional conduct and prevent many from falling into temptations; and gradually it might collect the cases on which it has delivered opinions, and at least a suggestive code might be the result.

THE AMERICAN FORESTER: WHAT THE SOCIETY HAS DONE AND MAY DO FOR HIM

By D. T. Mason

Professor of Forestry, University of California

Delivered at the San Francisco Meeting, October 18, 1915

The men who originally organized the Society of American Foresters had in mind accomplishing certain objects, which are expressed in the constitution as follows:

"The object of this Society shall be to further the cause of forestry in America by fostering a spirit of comradeship among foresters; by creating opportunities for a free interchange of views upon forestry and allied subjects, and by disseminating a knowledge of the purpose and achievements of forestry."

It was recognized that the American foresters could accomplish most for the advancement of forestry through friendly co-operation. Good team work is far more effective than unorganized individual effort. It was, then, the aim to produce an organization which would bring and hold American foresters together, so that they would receive the inspiration and benefit of working as members of a group rather than as isolated individuals. The organizers of the Society doubtless had in mind the development of high ideals among American foresters, gained from the comradeship of the members working in close association. It was, and is, highly desirable to inspire foresters to do those things which raise the standards of the profession, advance the interests of forestry in America, and gain recognition for this young profession from those in other professions. Opportunities were to be created, through discussion in meetings and in print, for a free interchange of views upon forestry and allied subjects. A knowledge of the purposes, ideals, and achievements of forestry were to be disseminated not only to Americans not engaged in forest work, but to American foresters as well.

While these objects have, in a greater or less degree, been accomplished, it is the purpose of this paper to analyze the situation, so far as possible, and to see what steps, if any, may be taken to secure a more complete and effective realization of the worthy objects set forth above.

For many years the Society held meetings only in Washington. This was natural, for in this locality only was any considerable number of foresters concentrated, giving a group sufficiently large to justify holding

meetings. The meetings of the "Baked Apple Club" were effective, for those fortunate foresters who happened to be at hand, in drawing them together and making them feel that they were working as members of an organization rather than as individuals. For these particular men, however, this drawing together was least necessary, for these men were usually already members of a far more highly developed organization; for these men, although the meetings may sometimes have seemed too much like a continuation of the day's work and associations, the meetings were important in developing that valuable spirit of comradeship; but how much more important and inspiring would such meetings have been to the widely scattered foresters not working in close touch with one another or with any large organization, had they been able to attend the meetings?

The opportunities for interchange of ideas afforded by the Society consisted principally of the presentation and discussion of papers at these Washington meetings and their publication in the Proceedings, which, before 1909, consisted entirely of papers presented before the Society.

A knowledge of forestry has been disseminated by the Society through the publication of the Proceedings, principally to its members and to other foresters; it has not, as an organization, reached the general public to any extent, although of course its individual members have done a great deal in this direction.

A responsible body of forestry leaders, mostly members of the Society, has developed, which has guided and directed forestry thought quite largely and has aided materially in forestry propaganda work.

While the early work of the Society centralized in Washington was as effective as could reasonably be expected at that time, a feeling developed that the Society had outgrown localization in Washington; consequently provision was made in 1911 for the organization of sections. The first section was organized at Missoula, in February, 1912. Since that time other sections, at St. Paul and Portland, have been organized.

I am personally familiar only with the meetings of the Missoula section. In the last three years this section has done a great deal of good in forwarding the objects of the Society in the northern Rockies. Last winter, for instance, between fifteen and twenty decidedly live meetings were held. These were each attended by from twenty to thirty-five men, most of them not members of the Society, but engaged in forest work of one kind or another and deeply interested in forest problems. At the meetings there was much spirited discussion—in fact, the debate was quite torrid at times. It was planned to have meetings lasting about two hours at intervals of two weeks, but often a meeting would last three

hours, and then be adjourned to the intervening week to permit further discussion. These section meetings are doubtless just as valuable and inspiring to the men attending them as are the possibly more formal meetings in Washington. The provision for sections was certainly an important step in the history of the Society.

The accomplishment of the Society, then, up to the present time, apparently consists principally in stimulating somewhat the production of American forest literature, in affording a place for the publication of some of it, in fostering a spirit of comradeship, especially among those members who have been able to attend the meetings of the Society, and in an intangible way in inspiring and encouraging right ideals among American foresters.

Although these things have been done, it seems to me clear that the Society has by no means accomplished its objects in full measure or developed to a position of the greatest usefulness, and particularly for the following reasons: Not many members take a deep interest in the Society. In its membership it has tried to straddle two horses going in opposite directions; owing to the stumbling-block of "achievement," it has failed to make its benefits available to those foresters of the country who most need them; through the endeavor to swell the membership, the honor conferred by membership has been lessened. The Society has been so small that, with meetings held only in Washington until recently, most members in other places have taken little interest in the Society and are quite out of touch with its work. Such men frequently feel that the only thing received from the Society is the Proceedings, which does not, as its name implies, really record principally the proceedings of the Society, but consists very largely of contributed papers which might equally well be published in the Forestry Quarterly. In some cases, even papers presented before the Society are printed in the Quarterly. It is felt that these two magazines, publishing technical forestry literature, are of equal standing and to a greater or less extent duplicate each other's work—that is, there is little distinctively representing the Society in the Proceedings or representing it so clearly that it brings home to field men the conviction that they are members of a real live organization, actually accomplishing as an organization a considerable amount of good in the field of forestry. These field men, more or less out of touch with the Society, are sometimes inclined to feel that it is almost exclusively the possession of a group of men located in Washington. Some men feel that if they do not get their money's worth from the publications of the Society, there is only one inducement left to hold them in the Society, and that is the honor of membership. As the Society has

grown from a small group of men, mostly located in Washington, to a good many men, scattered individually or in groups over the entire country, the rules of eligibility have naturally been more or less differently applied from time to time and from group to group, with the result that there are members who have done a very great deal for forestry and other members whose achievements along forestry lines are not great. Thus the honor of membership is not so highly esteemed as it probably is in some of the other professional societies. At any rate, the Society has failed to hold the membership of a few of the leading foresters of the country, who would doubtless wish to retain their membership if they felt that the Society was accomplishing its objects in full measure.

On the other hand, the Society has failed to provide definitely in its membership for those foresters who are just beginning in the profession or who, although foresters for several years, have not "achieved" sufficiently to earn membership. Since this class must include the majority of foresters in the country, the Society is failing to make available the stimulus and inspiration of its membership to the men who are most in need of it and who will profit most greatly thereby. All reputable professional foresters in the country should be co-operating in a hearty comradeship to advance the interests of the cause of forestry and of the profession of forestry. Of course, large numbers and large honor attached to membership are diametrically opposed; the honor varies inversely as to the number of members. However, it is far more important that all reputable professional foresters of the country work harmoniously, shoulder to shoulder, in an organization whose ideal is the advancement of the interests of forestry than that honor be conferred through membership. And the honor feature may and should be taken care of in another way.

It is hoped that these criticisms will be taken in the spirit in which they are offered—not that of destruction, but with the idea of presenting clearly the situation as it appears to many members, and with the idea of hastening those steps needed to bring about a more complete realization of the objects for which the Society was founded. The Society is certainly not so successfully accomplishing its objects as to hold the full sympathy and energetic approval of all of its members. It is believed that there are several means by which the situation may be greatly improved. Dr. Fernow, in the Proceedings of January, 1915, sets forth a number of things which should be done, and it is mainly my purpose to bring some of those things before you again and to make some further suggestions.

In the first place, it is surely desirable to secure such an organization of the Society that it may most nearly accomplish its objects. It is believed that the present organization, with its eligibility rules, cannot fulfill this purpose. In order to be of the greatest benefit and inspiration to American foresters, it should have the membership of all men who are honorably engaged in the profession, whether men of achievement or not. This would bring many more men under the influence of the Society, giving them whatever benefits the Society may possess, stimulating them to higher ideals and to better work, through the knowledge of what other men are doing, through interest developed by the knowledge that most other foresters are fellow-members, and through the *esprit de corps* developed in the right sort of organization, but which cannot exist among scattered individuals. This would give to many men now outside of the Society an organization through which they could use more efficiently their energy for forestry, and an organization which will also direct their efforts into the most productive channels. This, in turn, will result to the advantage of the Society itself and of the whole profession, as well as in the advancement of forestry in general in America. An enlarged membership will help solve the financial difficulties of the Society, which are now shamefully embarrassing for a professional society.

Next let us consider the organization as just outlined the general membership, or junior membership, of the Society, and let us follow the example of other professional societies, establishing a senior membership, to consist of "Fellows of the Society," who will be men of considerable real achievement in forestry work in America—men who have been in the profession sufficiently long and achieved sufficiently highly to gain a national reputation in the profession. To be a Fellow, or senior member, would then be a decided honor, recognized as such throughout the profession of forestry and by men in other professions as well. The Fellows would constitute a body of the most responsible, most experienced, and most reputable foresters in the country, who would be the natural leaders of forestry in America. Election to the senior body would be recognition of special achievement and would thus stimulate junior members to do better work. The number admitted to Fellowship would be smaller and more wieldy, and hence would be better able to do the planning and guiding for the whole Society. The greater responsibility would be placed more definitely upon the more experienced men of proven ability. This arrangement, it is believed, would give those in other professions greater respect for the profession of forestry.

In order to provide this organization, several amendments to the constitution would, of course, be necessary. The following method of attaining this object is suggested as a working basis: Let us consider the present membership of the Society as constituting the general membership or junior classification, and by vote of all of the active members elect each year to be fellows, or senior members, say twenty men—the men of highest standing in the profession. The election could readily be handled by having a primary election by general vote of the Society, which would nominate, say, the thirty men with the highest number of votes, from which list the twenty would be elected on the final ballot. A similar election should be held each year for three or four years, after which the Fellows would select the new Fellows, or the elections might be continued in the hands of the whole Society.

The Society should stimulate the organization of sections, with the purpose of holding more meetings throughout the country, thus securing in many more of the members a real interest in the Society and in forestry, giving the benefit of the lively debates which frequently take place at section meetings, but which are not nearly so likely to take place in the literature of the profession, and giving a much greater opportunity for attendance at meetings.

It is believed desirable to have organized in Washington a section of the Society which will finance and conduct its own meetings, as do the sections now organized. This will promote a desirable feeling of equality among the sections and groups of men in different parts of the country. It might then be desirable to hold each year only one or two general meetings of the Society, for each of which one of the sections would be responsible. Each section should take a very active part in deciding upon what men, in the territory which it includes, should be admitted to general membership.

Special effort should be made to develop debate in section meetings, for there is nothing which clears men's minds and stimulates interest as does free, lively discussion. Perfect freedom of speech should be permissible and should be encouraged, both in remarks at meetings and in published articles.

It is believed also that it will be wise, when opportunity presents, to combine the Proceedings and the Forestry Quarterly, with the object of securing under one cover all of the professional literature of the country. This should result in economy of publication, binding, etc., and would probably give sufficient literature to justify the publication of a monthly, or at least a bimonthly, magazine, in which the news would be much fresher and in which discussion would be more likely to occur, owing to the greater frequency of the publication.

Definite plans should be made and committees should exist, both in the Society at large and in each section, to see to it that there is some definite program of work directed to the promotion of the objects of the Society. There are many questions of local or of national importance which deserve the consideration and efforts of the Society, such as Federal *versus* State *versus* private ownership of forests; National Forests serving the functions of both National Forests and National Parks; local State forest policy; municipal forest questions, and many others. The Society will accomplish more to further the interests of forestry in America and members will take far more interest if actually doing something.

Any organization which has any definite object in view (and what organization has not?) can accomplish far more if there is some one definitely employed as executive upon whom the responsibility directly rests and who is properly compensated for doing the work. The Society of American Foresters should have a paid secretary—even if at first it can afford to employ a man for only part of the time.

THE FORESTER'S DUTY TOWARD LUMBERING

By Geo. M. Cornwall, Editor "The Timberman"

Delivered at the San Francisco Meeting, October 18, 1915

I have been asked by your chairman to make a few remarks on the topic, "The Forester's Duty Toward Lumbering." This is not an easy task. I should say, however, that the forester's first duty to himself and the industry is to know all he can about the lumber business—theoretically and practically—at least some branch of it.

This is an age of specialization. The lumber industry is no exception to the rule. The forester, to be of real service to the industry, should be able in a general way to act as a sort of doctor and industrial economist. By doctor, I mean he should be able to diagnose a case of over-production or under-consumption. Not necessarily that his prescription could or would be followed, or that direct results would flow from its consumption, but in a general way he should be able to size up the situation and state with a fair degree of accuracy the basic conditions surrounding the industry. For instance: By feeling the pulse of the business he should be able to say if there has been a tendency toward torpidity in trade movement and the underlying causes. Was the sluggishness due to a natural cessation in building on account of panics, war, or other industrial disturbances? Have substitutes taken the place of lumber? Has the fact that 37 per cent of the 6,200,000 farms in the United States are now occupied by tenants been a contributing factor to a decreased use of lumber? What is the natural reduction in the purchasing power of a tenant as against a resident owner? Here is a mighty practical question, as the farmer has heretofore been a very large consumer of lumber. What has been the actual percentage of displacement of lumber by cement, which reached the unprecedented production of 92,000,000 barrels in 1913? In the same year approximately forty billion feet of lumber was manufactured. Statistics show that from 1902 to 1912 the cement production of the country increased 240 per cent and lumber 14 per cent, estimating that a barrel of cement used in a mixture of concrete of one to seven is equal to 700 superficial feet of lumber.

Is the tendency away from the farm and country towns to the cities; and, if such is the case, what is the effect on the lumber industry? The statement is made that during the past ten years the increase in the

country population has been 4 per cent, while that of the city has been nearly 40 per cent. Will the new city dweller be housed in wood as formerly? If so, how will it affect the business of lumbering?

Are the multifold new uses for concrete and steel permanent where they now displace wood? If concrete and steel are the natural successors of wood for specific purposes, due to a higher use value, the industry wants to know it, and that right quickly. The forester should be able to tell us.

Taking up more particularly the economist's relation of the forester's duty toward the lumber industry: This is a pretty broad and comprehensive topic. The outer edges only can be touched on in this paper.

We will first discuss briefly the utilization of wood in the manufacture of by-products, such as pulp and paper. Are the conditions opportune and the profits certain enough to induce the average sawmill or group of mills to engage in the manufacture of pulp? Could a market be found for the enormous quantities of pulp which could be made from the sawmill refuse on the Pacific coast, which now either finds a market as fuel or is consumed in the burner? There were imported into the United States from Scandinavia in 1913 over 130,693 tons of wood pulp. Canada exported to the United States in 1913 362,733 tons of paper and wood pulp. The imports of paper from Canada have increased nearly six times in five years. Over 50 sawmills in Sweden are associated with pulp and paper mills. Here is an opportunity, if a way could be found to manufacture and market the pulp profitably, to effect a tremendous saving of material now going to waste by its conversion into a higher condition of utility. The growth of the pulp industry as reflected in the manufacture of fiber boxes and wall board is a new type of wood utilization. It is lumber in another form. Has it come to stay or is it merely a temporary expedient?

Would it be in the interest of true forestry and scientific conservation to diminish the use of wood in its sawed form and transform the tree as far as possible into pulp products? If, on investigation, it should be found practical to make this transformation, what would be the cost of the material, expressed in board feet, as compared with lumber for the uses to which it is adapted? The Forest Service Circular No. 171 says: "The loss in the mills is from one-third to two-thirds of the timber sawed. An average of only 320 feet as lumber is used for each 1,000 feet which stood in the forest." A Maine lumber company is quoted as using 90 per cent of the tree through the combination of a saw, pulp, and paper mill. The character of the timber, however, would be the controlling factor in permitting close utilization. The maker of fiber board is able

to tell to a fraction of a pound what it costs to manufacture the product and its relative use value as compared to wood. The forester should be able to give the lumbermen these facts.

The fiber box—it is here to stay, undoubtedly. How far has experience demonstrated its limitations for the safe transportation of goods as compared to the wooden box? Is it practical to increase its scope of service or otherwise? Would a group of sawmills be justified in building a co-operative pulp mill to convert refuse into pulp and manufacture fiber as well as wooden boxes? It has been estimated that about 10 per cent of the lumber production is converted into boxes. What is the difference in cost of manufacturing the fiber box as against the wooden box? What is the difference in the selling price for the same dimensions of boxes? These questions go right to the heart of the utilization of by-products and are simply thrown out with the idea of presenting the subject from a practical standpoint.

What is the cost and relative quality of turpentine produced through a destructive distillation process as compared to the characteristic methods applied in the Southern pine belt? What species of wood other than the pitch pines are best adapted for the distillation of by-products, such as turpentine, oils, tars, and rosins? What is the initial cost of a plant which would be commercially practicable and the selling price of its products?

What have been the contributing factors in the development of the Woods Products Company of Buffalo, N. Y., which embraces something over one hundred plants extracting wood alcohol, acetate of lime, and other by-products from hardwood? Was its success largely attributable to its co-operative selling methods and intelligent distribution? From a personal knowledge of this particular company, it is safe to say its success was predicated upon its co-operative marketing organization and a study of the possibilities for the enlarged use of its products.

Creosoting of lumber: This is a distinct branch of the lumber business. Upon its extension depends very largely the future use of wood and the opportunity to compete successfully with steel for certain construction purposes. What is the relative life of a creosoted bridge stringer as against an untreated stringer and against a steel beam which must be kept painted to preclude erosion? It is accurate and definite knowledge of this character which the forester should be able to furnish the lumberman.

Wood-block pavement offers a field for the extension of wood. What woods are best adapted for this service? How many pounds of creosote per cubic foot shall be impregnated into the wood to insure maximum

durability? Is timber cut in the fall or winter, when the sap is down, preferable for wood-paving use? What is considered the best system of laying wood-block pavement? What are its limitations? What is the cost of a properly laid wood-block pavement as compared with asphaltic, Belgian block, or brick? The average lumberman is unable to answer these questions intelligently. The forester should be able to help him.

In Sweden immense quantities of timber are converted into charcoal—which reaches the figure of 1,655,300 cords of charcoal per year—and employed in smelting iron. Would it be commercially practicable to convert wood waste into charcoal and employ it in smelting iron in the United States? Let us go a step further and see if charcoal briquettes would be either practical or desirable as fuel. There is a limited use of charcoal for culinary purposes. To what other uses can charcoal be put? The forester should have this information. Sawdust briquettes are being manufactured at Long Beach, Cal., on a commercial basis.

There has been a marked tendency of late years to eliminate the mill-construction type of building for factory and warehouse purposes. Experience has proven the adaptability of this type of building with its low fire hazard when equipped with automatic sprinkling systems. The forester should be able to give comparative costs of mill-type construction as against concrete, steel, and brick, pointing out the advantages of wood from the standpoint of ease in remodeling, low fire hazard, and the health of the operatives.

Basis of stumpage values: Assuming, for the sake of illustration, that the price of fir lumber in the States of Oregon and Washington has averaged about thirteen dollars for the past twenty-five years, and assuming that there will be but little difference in the range of prices during the next quarter of a century, what would be the fair value of stumpage, assuming that the cost of logging would remain practically at the same figure?

This question may seem rather far fetched, but it is nevertheless a mighty practical and interesting conjecture. The price of timber must conform to the selling price of lumber. Is it possible to increase the price of lumber through standardized manufacture, studying the needs of the consumer, and more intensified distribution? If this is the key to increased stumpage values, what plans have the foresters in mind to be pursued in developing a wider market for lumber? Should it be sold in short lengths, say from 2 to 4 feet, carefully planed, and adapted for household necessities and available in every department, hardware, paint, and furniture store, and every corner grocery in the country? Has the experience with other commodities offered in small quantities justified

this assumption? Should the manufacturer of lumber seek to sell to the consumer direct or should he supplement the retailer?

A canvass of 1,500 farms in Alberta and Saskatchewan revealed the fact that only about 13 per cent of the farmers protected their agricultural implements from the elements. What does a similar canvass show in the farming districts of the Middle West—the granary of the nation? Could the agricultural implement dealers successfully sell portable buildings to house these tools, keeping in mind, as stated at the outset of this paper, that there are 6,200,000 farms in the United States? What is your judgment?

Would a house-to-house canvass by skilled builders and designers, showing how changes and alterations could be made, leaving a complete sketch and estimate of the lumber required in the hands of the owners, stimulate building? If so, to what extent?

These thoughts are thrown out at random with a view solely of drawing your attention to the intensely practical side of forestry, which in the end must be the controlling factor in establishing your position in the industry. I have said nothing of forestry from its scientific standpoint as represented by your profession and which finds concrete expression in the Society of American Foresters.

Reproduction of timber: What does it cost to grow timber and who should grow it, and under what conditions? What has been the experience of other countries? Should the individual attempt reforestation as a business proposition or should the growing of timber be regarded as purely a State and governmental function? If an individual attempted to grow timber, in what sections of the United States could it be best grown and what varieties would be most profitable, taking into consideration rapidity of growth and its ultimate use? Luther Burbank, the famous horticulturist, has developed a species of walnut which will grow faster than eucalyptus. Would it pay to grow cottonwood or balsam for pulp in the deltas or bottomlands? The Willamette Pulp & Paper Co. of Oregon City, Oreg., has several hundred acres devoted to the growing of cottonwood for pulp wood. Their experience shows that 450 cords of pulp wood, worth one dollar per cord, could be harvested in fifteen years, or a gross return of $30 per acre per year. The experience of this company further demonstrated that in twenty years cottonwood trees attained a diameter of 19 inches, breast high, and 80 feet in height, with 60 feet clear length. In the practical value of cottonwood as against tideland or Sitka spruce (*Picea sitchensis*) for paper-making, it was found that its use value was low, owing to the shortness and brittleness of the fiber and the longer time and additional power it required to grind

as against Sitka spruce; hence the growing of cottonwood was discontinued. On the other hand, the value of cottonwood for the manufacture of veneer, boxes, and other packages is very high.

The element of taxation has a most important bearing on the growing of timber and the practicing of conservative lumbering. A tax on the yield, with a nominal annual tax on the land, must be in force before any marked strides can be made in private reforestation. One of the States—Pennsylvania, I think—recently enacted some deferred tax laws, with a view of making reforestation financially practicable. Some other States are falling in line. The forester should be able to educate the public in correct systems of timber taxation.

Examples of the ability of the forester to become a most useful factor in the broader field of lumber economics are not lacking, as well as in moulding public opinion to a better understanding of forest resources and their relation to the public. Conspicuous examples of signal ability are: E. T. Allen, forester Western Forestry and Conservation Association; C. S. Chapman, manager Oregon Forest Fire Association; R. S. Kellogg, secretary National Lumber Manufacturers' Association; O. T. Swan, secretary Northern Hemlock and Hardwood Association; A. W. Cooper, secretary Western Pine Manufacturers' Association; J. B. Knapp, manager Northwestern Association of Box Manufacturers; H. D. Langille, Pacific Coast manager Jas. D. Lacey & Co.; Dr. Judson Clark, forest engineer—all leading figures in association work and general uplift of the lumber industry. These foresters received their training in the Forest Service. Their technical knowledge gives them a broader grasp of forestry and all the subject implies. E. A. Sterling, timber engineer, has recently been placed in charge of the Trade Extension Department of the National Lumber Manufacturers' Association. In foreign fields we find H. R. MacMillan, chief forester for British Columbia, traveling in Europe and Africa and other countries developing trade for Canadian mills. Here is a most conspicuous example of the forester in the rôle of commercial ambassador. He must necessarily know what it costs to produce lumber and its profitable selling price.

In China, Chief Forester Bailie is undertaking to establish a school of forestry, and his principal endeavor will be the reforestation of large denuded areas. In the Philippines the management and handling of the forests are being successfully carried forward by the forest service. The Philippine foresters are assisting in disseminating knowledge of more improved methods of lumbering in our insular possessions, and are engaged at this time in exploiting the markets for Philippine woods. In Australia the forest department of New South Wales attests to the char-

acter of lumber shipped to foreign governments. Some agitation has been going forward in the United States with a view of conferring similar authority on the United States Forest Service. A recent case in this connection was noted in British Columbia, where the Forest Branch secured the placing of a trial order for creosoted Douglas fir (Oregon pine—*Pseudotsuga taxifolia*) ties for the Indian railway service. The order was predicated upon government inspection. Here, again, was an example where technical knowledge of wood and of creosoting methods were inseparably linked. The forester was able to bring his knowledge to bear successfully in this particular case.

Recently an order for redwood ties for the British railway service called for a government inspection certificate. It could not be given. The best that could be done to satisfy the foreign buyer was an endorsement of competency on the part of the inspector by the forest service. These incidents only go to show that foreign governments regard the technical knowledge of the forester on the same plane as men engaged in other branches of engineering science. In the United States we must come to accept the same viewpoint, but its achievement will be hastened through a practical knowledge of the industry by the professional forester.

Germany has perhaps the most advanced forestry system in the world. In her colonies she has successfully carried forward German ideals of forestry. The reforestation of Tsingtau, a German possession in the Shangtung peninsula, is one of the most conspicuous examples of her reforestation policy.

In the Malay Archipelago the Dutch government practices a most systematic forest policy in the handling of its hardwood forests.

In India the government maintains two forest schools for the English and native students.

The forest service of Japan is in keeping with the progressive spirit of that Far Eastern government.

The Argentine Republic has called upon Forester Curran, formerly connected with the Philippine Forest Service, to shape and direct its forest policy.

In British Borneo, Forester Matthews is assisting to introduce steam logging to displace elephants and pointing the way to general improved lumbering methods.

Many other examples could be cited of the interest in forestry throughout the world, including the forest management in the Hawaiian Islands, which embraces agricultural development as well as forestry in its scope.

In California the growing of eucalyptus has been undertaken to some extent by the Santa Fe railroad and by private concerns. The California

Eucalyptus Association recently held a conference to discuss conditions surrounding the industry.

In the past the government has absorbed a large number of graduates of forest schools. This can no longer be done, as the supply is increasing. Foresters must therefore look for new fields. The lumber business offers opportunities for young men, but they must be willing to start at the bottom and work up, competing with those who have not studied forestry. As the time goes on, undoubtedly a forestry course will be considered the proper one for a young man desiring to follow lumbering in some of its phases as a business. Foresters entering this field will in time result in better understanding of the relations of forestry and the industry. Forest schools should give and are giving more consideration to the economics of the lumber business and paying more attention to the woods, logging and manufacturing branches of the business.

It will doubtless be a long time before the lumber companies in the West will practice anything like intensive forestry. However, there are many things which can be done to help toward ultimate scientific forest management, and these things should be more keenly realized by a forester than by one with no such training. For instance, the forester should be able to advise the sawmill operator how best to cut timbers for mill type of construction, so as to avoid checking and failure, as far as possible. He should have a knowledge of dry kilning in order to prepare lumber for shipment, thus diminishing the cost of transportation and increasing the use value of the product. A forester who understands the scientific principles of drying lumber and reducing checking to a minimum has an assured place in the lumber industry.

There is a demand which daily becomes more insistent that lumber and shingles should be treated so as to render them more fire-resisting. Here is a field that is wide open to the forester.

The relative strength of timbers and their proper uses should be part of the forester's capital knowledge.

In the utilization of by-products the manufacture of excelsior is worthy of consideration. What woods are best suited to this purpose, and what is the estimated cost of production per ton? How large an investment is necessary to insure commercial success? Are there any new markets being developed for excelsior? Is the market possible of expansion? Here is an excellent opportunity for studying a by-product of which but comparatively little is known.

Scientific farming necessarily implies the use of silos for insuring a supply of forage. Some species are better adapted for silo construction than others. What species of lumber have proven their undoubted avail-

ability for this service? What type of construction is best adapted to withstand the internal and external pressures? What advantages or disadvantages has the wood over the concrete silo and its comparative initial cost? What advantages or disadvantages has a creosoted silo over an uncreosoted silo, both as to the point of service and contamination of the ensilage? Does the German Roeping vacuum process of creosoting remove enough of the creosote to reduce the liability of contamination to a minimum?

What are the marked characteristics and value of redwood for tank and silo construction? What is the relative use value of cypress as compared to treated or untreated Douglas fir, redwood, white pine, or yellow pine for silo construction? Intensified marketing of lumber to the farmer must necessarily imply a thorough knowledge of woods best adapted to his particular service. Who should be better able to give him this information than the forester?

A knowledge of logging engineering, as Dr. Schenck, formerly of the Biltmore Forest School and a German forester, always stoutly contended, is the basis of true forestry. The familiarity of the most improved systems for removing the timber at the least possible cost is equally as essential as a knowledge of growth and protection.

The entire field of lumbering is undergoing an evolution both in methods of production and distribution. The forester's training should harmonize theoretical knowledge with the practical every-day experience. In the reshaping of the industry the forester should be able to help steer a safe course and point the way toward higher ideals and sounder business principles. This is a goal worthy of achievement and is, in my opinion, the highest duty of the forester toward lumbering. It can all be summed up in one word—service.

THE PLACE OF LOGGING ENGINEERING IN FORESTRY

By Dr. Judson F. Clark, Consulting Forester

Delivered at the San Francisco Meeting, October 18, 1915

The aim of the art of the logging engineer is to lower the cost of harvesting the forester's crop. A lower cost of harvesting means higher stumpage values.

The foundation of forest finance is stumpage value. The forest has many values aside from its stumpage returns, and these values are often of the utmost importance to the community as a whole, even from the financial standpoint; but—the inevitable *but*—it is the stumpage that pays the bills and makes possible and profitable the practice of forestry.

It will, I think, be readily conceded that the greatest hindrance to the progress of forestry in this country is the low stumpage values. In Europe, where labor is much cheaper and stumpage values several-fold higher than with us, forest properties may be maintained on a perpetual yield basis and pay a fair return on the investment. What obtains in Europe today will obtain in America tomorrow. The practical question is, How may we hasten it? In a large measure the answer to this question will be found in the development of the art of the logging engineer.

Stumpage is that which remains when the cost of marketing the forest product has been paid from the returns from the sale. Obviously, there are but three ways of increasing stumpage values. We may do so by raising the price of the product, by eliminating waste, or we may reduce the costs of marketing.

Unhappily, the price of lumber, the main forest product, is determined by a great variety of considerations, most of which are wholly beyond the control of the friends of the forest.

The utilization of materials previously wasted makes slow progress. There have not been nearly so many by-product developments as could be wished, and every step in advance—no matter how rich in early promise of good financial returns—largely defeats its own hopes on account of the overwhelming supply of raw materials on the one hand and market limitations for the product on the other.

Until such time as lumber prices substantially and permanently advance, the main hope of bettering forest finances, and thereby widening the field where forestry may be practiced, rests in the *lowering of the costs* of marketing the forest crop.

The cost of marketing the forester's crop may be roughly classified as logging costs, milling costs, lumber transportation, and selling costs.

The sawing and finishing of lumber, together with lumber transportation, have already been highly standardized. No doubt many further economies will be effected in these departments from time to time. A start, which has every promise of large results, has already been made in the heretofore much neglected field of lumber salesmanship. But perhaps the largest field for economies is that of logging, and the hope for greater efficiency in this quarter is in the development of the art of logging engineering.

As the art of the farmer in producing the crops that feed and clothe the nation calls to its aid so much of the science of chemistry, physics, and biology, so the logging engineer in the development of his profession takes toll from the whole field of the mechanical sciences, and, hardly less insistently than the automobile manufacturer, calls for much of the best that has been produced by that modern alchemist, the metallurgist.

No occupation calls for greater resource and adaptability. Every logging unit differs from every other in a complexity of variations in topography and stand; and of the thousand ways in which the logging may be done there are not many ways that admit of profitable results, and there is, of course, only one best way.

The man who knows and who can effectively carry out one or more of these better ways is a potential logging engineer—and the logging industry is proud of the many conspicuously successful loggers who are daily adding to our knowledge of the art, to the dignity of the profession, and to their bank accounts.

The successful logging engineer of the past has been a man who has compelled success by a more than average ability and adaptability. How may the average logging foreman improve his methods, and thus take the first steps to qualify as a logging engineer? Must it not be by bringing to him the results of the best thought of the thousands of men who are devoting their lives to this work?

The trade journals have done a very great and ever-increasing service in this work, and must ever be the least expensive of our educational resources. The Pacific Logging Congress has brought together the leaders in the profession to their very great mutual benefit. It has also influenced a fringe of the rank and file. The trade journals and the Logging Congress will continue to be increasingly useful in their special fields of activity, but it is to the schools that we have a right to look for leadership.

I would suggest that the time has come when the schools should provide for specialization in their forestry instruction. Such specialization

would enable students looking forward to government service to prepare either for administrative positions or for silvicultural work in all its broader aspects; for the students who look forward to private employ, the specialization will be along the varied lines of forest engineering. The specialization called for in the past for private work has been very largely along the line of modern methods of forest survey. For the future may we not hope that specialists may find a wider and still more remunerative field in various lines of lumber manufacturing and utilization, in lumber merchandising, and especially in the department of logging engineering?

The graduate of the forest school, with a special training in the department of logging engineering, may hope to be of considerable service to a logging company from the start; but to be of the greatest service in the end, he must be willing to start his practical apprenticeship at the bottom and work up. This may mean sixty dollars a month or it may mean forty. The coming logging engineer will choose his company and then compel them to take him on, if he has to volunteer his services at the start. Once in the harness his sole aim will be to make himself indispensable to his company, and the man who combines ability with a thorough training in the fundamentals of his art will quickly arrive.

Having mastered his profession and having established a reputation, a successful logging engineer may hope for a large and remunerative opportunity as a specialist, who will determine the method of operation best suited for any particular combination of stand and topography, and perhaps supervise the installation, leaving the less difficult task of operation to cheaper men.

There is perhaps even a larger work than that of training the logging specialist open to the forest schools in the development of a course for the average logging foreman. A four or six weeks' course for this class of men, without entrance qualification other than a desire to learn, in which all the latest and best ideas in the art would be examined and wherever possible studied in practical operation, would be of the greatest value.

Camp construction and sanitation, economy and efficiency in the boarding department, camp accounting and welfare work would be some of the subjects to be included with the more picturesque problems involved in the bringing of the logs to the rail or water and thence to the mill.

It is not impossible that the forest schools would find in this direction their very greatest usefulness in promoting business economy and therefore conservation. It would not be an unreasonable hope that such a course would result in a 5 to 10 per cent cut in average costs with the average foreman attending. Not the least value of this economy would

be its effect in making possible (by making profitable) a closer utilization of the lower-grade materials.

To sum up, then, logging engineering is at present our best hope for the larger stumpage returns so necessary for the extension of forestry methods. In the past it has been developed almost entirely by practical men, who have had but limited opportunity to know and see what the other fellow was doing. For the future the forest schools should become clearing-houses for information discovered and better methods developed all along the line, and thus become at once the source of supply for our specialists and the training ground for our every-day foreman loggers.

THE LUMBERMAN'S DUTY TOWARD FORESTRY

By Frederick E. Olmsted, Consulting Forester

Delivered at the San Francisco Meeting, October 18, 1915

The words lumberman, duty, and forestry all have broad definitions. When we speak of a lumberman we mean one who owns or controls trees, cuts them down, saws them into lumber, and sells the product. He does this for a livelihood and occasionally at a money loss. In this country he has done it in much the same way since 1620, if we except marked improvements in mechanical methods of logging and manufacturing. A lumberman is a dealer in trees, with an eye to present profit and comparatively small regard for future conditions.

Forestry has come to be interpreted so mistakenly that it is taken to mean everything from the care of geranium beds in cemeteries to edicts prohibiting the lumberman from cutting his own trees unless he be so charitable as to plant two seedlings in place of each veteran he fells. In plain words, forestry is scientific management applied to the protection, appraisal, and use of trees and tree products. When the trees are owned by the State (the word State being used in its broadest sense), forestry aims to make the investment a permanent one, so treating the land that it will always produce wood crops.

Duty, for purposes of this discussion, may be defined as an obligation that the lumberman should fulfill for his own good and the good of the State.

With this understanding, then, what is the duty of the lumberman toward forestry? Essentially, it is to keep an open mind toward forestry. He should be receptive in two ways: First, to understand thoroughly how the public ownership of timber lands under scientific management may affect his own business both now and in the future; second, to determine what principles of forestry as practiced by the State might be applied to advantage on his own lands. He should consider these matters for his own immediate business good and in a spirit of friendly co-operation with other private owners and the State. Without such co-operation it will not be possible to carry on in the future a permanently profitable lumber business.

It is well worth the lumberman's while to inquire closely into the methods of forestry as applied on the National Forests. Has he a clear understanding of why the people of the United States own two-fifths of

the standing timber of the country, and does he know what they intend to do with it? Is he familiar with the many intricate policies involved in the management of this public estate, and does he realize how these policies may affect his own undertakings, both now and in years to come? Has he been content to condemn or deplore the public ownership of timber lands, or has he thought out for himself whether, in view of this firmly established public policy, he might not profitably modify his own methods? Has he kept his mind open?

Does the lumberman know why the Forest Service protects government lands against fire? Does he know how it is done, what it costs, and what the returns on the investment may be? Does he realize that systematic methods of fire prevention, fire detection, and fire fighting have revolutionized the problem of fire control? Has he considered that merely by creating a better sentiment in his community regarding damage from fire he might avoid heavy losses? Has the lumberman dismissed this subject from his mind with the off-hand decision that State methods of protection are neither practicable nor necessary on his own lands? On the other hand, has he kept his mind open as to whether a modification of such practices might not be of real benefit to himself, to his community, and to the State? Even if he believes that the ordinary fire causes small damage to his standing trees, is he positive that a moderate expenditure each year toward fire prevention would not save him a great many dollars in fighting the big fires which occur from time to time? Conflagrations may damage or destroy not only his own timber and logging plant, but may spread to surrounding lands and injure the property of others. Has he figured out this problem with the same care he uses in figuring his costs of manufacture? Has he ever calculated in dollars and cents the loss resulting from fire scars in his butt logs? At what rate of insurance might he prevent such damage in the future? Has the lumberman's mind been open to these questions?

In the appraisal of standing timber there is decided need for the lumberman to keep an open mind. He might well inquire what the forester can do for him in estimating the amount, kind, and value of his stand and in mapping the country of his future operations. This might enable him to cut, log, transport, and manufacture his product more systematically and more cheaply. The essential advantage of the forester's method of appraisal over that of the old-time timber cruiser is that the forester eliminates three-quarters of the guesswork which was formerly inevitable and which gave wide scope to the judgment of the cruiser. An estimate of timber under forestry methods is simply the application of scientific principles to the measurement of trees. To be sure, the factors of defect

and breakage are still not capable of exact determination; but even here the forester has greatly reduced the guesswork element; and, given a little more time and experience, he will eliminate practically all of the uncertainty. Does the lumberman know how this is being worked out and put into practice? In the application of scientific principles to the inventory of his raw material, has the lumberman kept pace with other great industries? Is he acquainted with the cost of the forester's method as against that of the old-time guesser? Perhaps the forester's system is less expensive. Has he figured, too, the probable gain resulting from the more exact, more reliable, and more useful information the forester might give him? Has it occurred to the lumberman that valuable results might follow if the practical knowledge and experience of an expert woods boss were taken and applied systematically by the forester?

Forestry sometimes implies a treatment of timber lands which aims to produce continuous crops of wood. It goes without saying that fire elimination is the first essential to such a policy. Moreover, if we are to keep the land producing timber, we must leave enough trees to warrant another cutting, or leave trees as distributors of seed for a new growth; or if we strip the land clean, we must restock it artificially. In any event, this policy of keeping the land productive necessitates some present money loss and calls for the avowed intention of holding the land as an investment for future crops of timber. In foreign countries such a policy is the chief part of forestry and has been in successful operation for years—because it pays. In this country it is the chief part of forestry on State lands—because it pays. But here it is not the most immediately important part of forestry on privately owned timber lands, because under existing economic conditions it is doubtful whether it pays. The State is assured of small returns on its investment after long periods and derives, also, many indirect advantages from keeping its land producing wood. The private owner, having in mind the unsettled conditions of taxation and land ownership, and being in doubt as to his ability to secure reasonably stable market conditions in the future, frequently decides that holding his property for future crops of timber is altogether too hazardous a proceeding, promising at best smaller returns on his capital than he could obtain by putting his money to many other uses. The private owner is generally right in this respect.

Occasionally he may be wrong. If his lands produce a certain kind of valuable forest product which is becoming scarce, and if it is reasonably sure that the market will continue to demand that certain product for years to come, it is merely common-sense business to take such practical measures as will keep his lands productive after the first cutting. He

must, of course, decide whether the carrying charges will permit such an investment, and if the chances are against him in this he will endeavor to remedy conditions, co-operating to that end with the State.

Again, let us look at the problem of handling timber lands for future crops from another standpoint. Let us admit, for the pleasure of argument, that the private owner in this country will never be able to hold his logged-off lands as a future timber investment because the returns will never justify him in doing so. There is a large amount of land in the United States which will always be valueless unless it is made to produce wood, and most of this land is in private ownership. What, eventually, will become of logged-off lands? It is inconceivable that they will always remain idle and unproductive. Through some agency, possibly that of the State, all lands best suited to the growth of wood will be kept producing trees, regardless of how high a return on the investment results. Has the lumberman kept an open mind on this subject? Has he made so much as an old-time cruiser's guess as to how soon the State may be forced to acquire and manage such lands? Is he sure that action may not be taken during his own lifetime or that of his children? The State moves rapidly nowadays. Would it be unfair to add that possibly both the State and forestry have recently moved ahead faster than the lumberman?

It is safe to say that most of the logged-off lands are now held not with any specific end in view by their owners, but with the speculative instinct that "something may turn up" to give them a future value. Why not make the speculation somewhat more promising? Has it occurred to the lumberman that the State would, as a matter of course, pay a higher price to acquire lands which had been so cut over and protected from fire that they were supporting thrifty stands of young timber? Has he considered what the difference in money value would be for stripped, barren lands which the State could make productive only by planting at a high cost, or lands so cared for during and after logging that they support good stands of useful trees fifty, forty, thirty, twenty, or even but ten years of age? If it should cost ten dollars an acre to plant barren lands, how much more would the State pay for lands well stocked with such trees, figuring interest on the cost of planting and the expense of protection and upkeep? Would not forested lands be purchased far in advance of barren lands? At any rate, this is a subject worthy of serious thought.

When discussing with the forester the difficulty of applying forestry methods to his own lands, the lumberman frequently makes the statement that conditions surrounding his own operation are peculiar and different from those of other localities, so that changes from his estab-

lished methods are hardly to be considered. To this the forester replies once again that forestry is merely a science applied to the management of timber lands, and that this science may be applied in as many different ways as there are different conditions. There are numerous ways, for example, of securing reasonably good stands of young growth when the lands are logged, and many of these ways are inexpensive. Does the lumberman know what it costs the State to provide for the future productiveness of its lands? The figures are available.

In years gone by the lumberman, with good reason, has taunted the forester for his ignorance of practical lumbering conditions. The forester has grown and, although he still has much to learn from the lumberman, he now knows that turn about is fair play. He asks that the lumberman keep an open mind toward forestry; that he take a lively interest in those problems in the solution of which the forester might assist him, and that he then apply to his own lands such methods of forestry as may work for his own practical advantage and the ultimate good of the State.

SCIENTIFIC NOTES AND COMMENTS

Working Plans on National Forests

No one will take exception to the arguments advanced by Mr. Kirkland in the October issue of the Proceedings[1] in favor of a sustained annual yield in the management of National Forests. Stability in social and economic conditions, including the forest-using industries themselves, and in local revenues is assuredly the goal to be attained as soon as possible.

I wish to offer but two comments on Kirkland's discussion. The first is that primary transportation must precede any kind of forest management. It is useless to talk sustained yield or any other form of regulation in regions absolutely shut off from a market for their products. Transportation must be had first. Railroad construction often depends upon immediate timber exploitation on a large scale. Other resources alone or limited lumbering operations will not bring it. In such conditions the government has made or offered large sales, believing this to be a better public policy than to postpone indefinitely any form of utilization and any possibilities of forest improvement or management.

My second suggestion is that management with or without the sustained yield principle is totally unrelated to the policy followed in pricing stumpage. Prices may be high or low, appraised conservatively or otherwise, under either a system of sales based upon sustained yield or one devoid of such regulation. The appraisal system of the Service is the same on all National Forests. Its prices are neither liberal nor speculative. They represent as closely as it can be arrived at the normal market value of the timber. This uniform system of appraisals is applied on Forests already under a close sustained yield management, most notably perhaps in the turpentine sales in Florida; in thousands of small sales where the annual cut is still less than the yield, and in the occasional large sale where, to secure transportation and make any kind of utilization possible, it is necessary to plan for a periodic, rather than annual, yield for a season.

The management of the National Forests as a whole is perhaps not so far from Kirkland's ideals as he may imagine. The Service is making

[1] The Need of Working Plans on National Forests and the Policies Which Should be Embodied in Them. Burt P. Kirkland, p. 341.

upward of 10,000 timber sales a year, largely, of course, in small amounts to local operators, jobbers, and settlers. In 99 per cent of them there is all the stability that could be asked, with utilization still below the yield of the forest. But there still remains the big technical problem of administration—to utilize our surplus of more than 250 billion feet of mature timber and realize upon the potential growth of the enormous area which it occupies. There is only one way by which this can be done and keep within a sustained yearly cut with no breaks on all units, namely, by the construction and operation of transportation facilities by the government itself. Otherwise we must do the best we can, with the commercial conditions as they are, to accomplish something in the way of utilization and silvicultural improvement, even if it means for the present overcutting the yield of certain units. The development of technical management must necessarily be gradual, bringing each unit upon a sustained yield basis as soon as the conditions controlling its exploitation will permit.

The first step in this direction, already taken, is to insure a supply for each new mill adequate to round out its full operating life, usually estimated at not less than twenty years. A request for a sale of timber on a well-developed forest in the Southwest was recently rejected in accordance with this principle.

The unit for sustained yield must necessarily be flexible and related to the industrial development upon which the use of the timber depends. It may be the loggable territory tributary by rail or drivable streams to a milling center like Cœur d'Alene Lake, or the region accessible at practicable logging costs to a great local industry, like the Montana Copper Mines. Even the territory drawn upon for a single mill or group of mills may, by progressive railroad development, become quite unrelated to watersheds, as in the Blue Mountains of Oregon. While the single watershed will doubtless form the most satisfactory working circle in many cases, I see no reason why the principle should not adapt itself to such conditions as these, whether the areas dealt with be defined as "market" units or "producing" units.

W. B. Greeley.

Weight of Western Yellow-pine Logs in Arizona

From original data loaned the writer by a representative of the A., T. & S. F. Railway Company, the average shipping weight of green western yellow-pine logs was determined on the basis of the measurement

of 11,600 logs near Bellemont, Arizona. The average load hauled on the Russell logging cars was 26 logs, scaling 4,520 feet board measure. The average log scaled 174 board feet, and the average actual weight per thousand feet was 9,992 pounds. In the table which follows, however, it is noted that there is a considerable divergence between the maximum and minimum figures. For example, for section 14 the average weight per thousand was 9,392 pounds. The maximum weight for sections 20 and 29 per thousand was 10,711 pounds. The heavy weight for these sections is due to the fact that the material shipped consisted of an unusual number of small logs cut from trees locally known as "black jack." These trees have a considerable portion of sapwood and are ordinarily under 150 to 160 years of age. The figures follow:

Section.	No. cars.	No. logs.	Amt. feet.	B. M. weight.	Wt. per M.	Av. log.
14.....	52	1,255	244,310	2,294,740	9,392	194
22.....	18	273	81,950	796,820	9,723	301
15.....	26	646	125,320	1,199,800	9,573	193
20 and 29 ..	30	810	126,230	1,352,080	10,711	155
14.....	68	1,648	314,980	3,026,440	9,608	191
30.....	252	6,968	1,125,730	11,499,180	19,124	161
Total.....	446	11,600	2,018,520	20,169,060		

THEODORE S. WOOLSEY, JR.

THE STABILITY OF ASPEN AS A TYPE

A great deal has been said, mostly without experimentation, as to the stability of various forest types. In District 4 it appears to be the tendency among administrative men to consider aspen as a permanent type. The viewpoint in regard to this matter is, of course, of the utmost importance in framing the policy relative to management. If aspen is a permanent type, it should, of course, be handled as such, and no underplanting of coniferous species should be undertaken; but, on the other hand, if aspen is a temporary type, it is hardly probable that we can assist nature in expediting the invasion of the climax species by underplanting, etc. Very extensive areas of aspen are found near the Utah Forest Experiment Station. Realizing the importance of ascertaining data as to the stability of aspen, effort has been made in that direction. For reasons which will follow, it is believed by men at the station that aspen is a

temporary type, which will be replaced slowly, but surely, by conifer. It has been repeatedly observed that while conifers can invade aspen, the aspen cannot invade conifer, and the few weak specimens found in even the densest of coniferous stands are the relicts of a previous aspen stand, which have not yet been crowded out by conifer. The cobweb fungus (*Herpotrichia*) seems to have little effect in maintaining the permanency of aspen against natural coniferous reproduction. So far as general observations are concerned, therefore, aspen appears to be wholly powerless to repel coniferous invasion, on the Manti Forest at least, except possibly in rare cases of white pine. Suppression has never been noted in the case of white fir, which is the most aggressive species. It is questionable, too, if Douglas fir can be shaded out; and it is well known, of course, that Alpine fir flourishes beneath aspen.

Some growth figures were obtained this year as a result of a permanent sample plot in very thrifty, dense aspen, established by F. T. McLain in 1910. A few Alpine firs were also located on the plot, although the stand was essentially pure aspen of first quality. The plot was remeasured this year.

During the five-year period the diameter growth of 142 aspen trees on the plot averaged .32 inch, while the 20 Alpine firs averaged 1.7 inches for the same period. Moreover, 8.5 per cent of the aspen trees had been killed in the five years by crowding, while all of the Alpine firs were alive and flourishing. It may be interesting to relate that one of the station thinning plots is located in even-aged, very "permanent" looking aspen nearly one-half mile from coniferous timber. The aspen stand is over 80 years old and no indication of a previous stand is visible. About 6 inches below the ground surface pieces of charred wood are found. Out of nine pieces of the charred wood picked from the soil there in three different spots remote from each other, according to microscopic examination, seven proved to be coniferous species and two broad-leaf, presumably aspen. It is very apparent in this case, of course, that a coniferous type occupied the area before the present aspen. Several other instances of this kind could be cited.

While there is a great deal of evidence to substantiate the belief that aspen in the Wasatch Mountains behaves as it does in Colorado and Arizona, for example, the Experiment Station is establishing plots to determine definitely the increment of aspen against conifer. We hope to carry the successional studies to an unquestionable point.

ARTHUR W. SAMPSON.

Notes on Trees

Chapman's (Fl. S. 421, 1860), Small's (Fl. S. 350, 1903), and Dr. Britton's (Trees, 302, 1908) characterizations of Michaux's *Quercus laurifolia hybrida* (Am. Ch. 10, pl. 18, 1801) are so different from material from Georgia that closely resembles Michaux's plate (l. c.), and which comes from well within the region traversed by Michaux, that it seems desirable to recharacterize the tree from this material. The salient characteristics of the foliage shown in the plate—there is no fruit—are that the leaves are broadest at the middle, cuneate at base, prevailingly with obtuse or rounded apices, not bristle-tipped, margins slightly undulate, often slightly unsymmetrical. The foliage does, in fact, as his description states, closely simulate that of a hybrid. Chapman says, leaves deciduous, petioled, 3-lobed; and he is followed by the other authors. In the Georgia specimens the leaves persist until late in winter, and would seem to represent a different species.

Quercus hybrida (Mx.). Twigs slender, glabrous, dark tan, dull, buds acute bright brown. Leaves, mostly grouped at the tips of the short twigs, *sessile*, oblong, 5-11 cm. long, 2-3 cm. wide, cuneate at base, broadest at the middle, abruptly acute or rounded at the narrow apex, frequently wavy margined and *unsymmetrical, but not lobed,* showing below many pairs of short, prominent, mostly forked veins, glabrous except for scattering tufts of pubescence along the slender, deeply impressed midrib, *dull pale green,* thin but *largely persistent until late in winter.* Nut subglobose, 10-14 mm. thick; cup glabrous, very shallow, slightly pointed base. Sandy banks of streams, eastern Georgia.

Quercus Atlantica sp. nov. A tree 20-25 m. in height, with a trunk diameter of 6-8 cm.; rough dark grey bark on its trunk and smooth light grey bark on the spreading and ascending branches, which form a broad, symmetrical crown. Twigs slender, 2-3 mm. thick, greyish, pubescent early in the season, at length nearly glabrous and dark red-brown, terminal buds ovate, 4-5 mm. long, abruptly acute, dark red-brown, pubescent.

Leaves irregularly falling late in winter, with entire margins 5-8 cm. long, 2-4 cm. wide, oblong or narrowly obovate or broadly spatulate, rounded or abruptly acute at the bristle-tipped apex, cuneate at base or gradually narrowed into short 5 mm. long petiole; glabrous except on the midrib and rounded petiole, beneath scarcely paler and sparingly pubescent, especially toward the base; midrib straw-colored, not impressed above, but standing out prominently beneath, with 4-6 pairs of prominent lateral veins which usually fork beyond their middles.

Fruit, ripening the second year, sessile or practically so; cup 14-18

mm. across, very thin, shallow, and obtusely narrowed to the base, the lanceolate, pointed appressed scales covered with short brown pubescence; nuts 14-17 mm. thick, 12-15 mm. long, pubescent, especially at the apex, very dark grey-brown striped with lighter brown, the broad base orange; kernel deep orange in color, bitter.

Eastern Georgia to northwest Florida. Type material collected by W. W. A., Lumber City, Georgia, November 10, 1915, growing on the edge of swamps. Mohr: Apalachicola, Fla., June, 1880; March, 1898; near Carrabelle, Fla., March, 1900. This tree might be considered a hybrid between *Q. cinerea* and *Q. laurifolia*, but for the fact that both fruit and foliage are larger than in either of these species. From *Q. hybrida* of the same region it is separated by its greater pubescence, much larger fruit, and differently shaped leaf.

Quercus sinuata Walt. (Fl. Car. 235, 1788). Specimens of a white oak collected to the north of Walter's locality, but well within the coastal plain, are referred to this long overlooked species and are evidently the same as *Q. austrina* Small (Fl. S. 353, 1903). A translation of Walter's description is: Leaves sinuate, smooth, obtuse, pale above, subglaucous below, acorn middle-sized, globose, cup nearly flat. Small's description, except for italics, is: " . . . leaf blades cuneate to oblong-cuneate, 5-15 cm. long, with 3-5 *blunt lobes* above the middle, *bright green*, but not lustrous above, white tomentulose, but soon become *glabrous* and *more or less glaucous* beneath, short-petioled, . . . acorns 1.5-2 cm. long." The cup is not described, but it is comparatively flat. Walter takes no note of the quite similar caducous pubescence of *Q. alba*, describing its leaves as smooth, bright green above, glaucous beneath.

This completes the identification of Walter's oaks. Considering the brevity of his descriptions, they are excellent, but each species must be considered in connection with the others that he describes. His *Q. rubra* is the southern red oak; his *Q. lævis* is *Q. Catesbæi*.

Quercus Walteriana n. n. The hybrid *Q. nigra* L. × *Q. Catesbæi* L. has been referred (Engelm., Tr. St. L. Ac. Sc., 3, 400, 1876, and Sargent, Silva 8, 144, 1895) to *Q. sinuata* Walt. This hybrid, however, has a cup with a round and not a nearly flat base; the foliage is dark green and lucid above and not pale, is bright green below and not sub-glaucous; nor is there a reference to its bristles. Walter's name, however, can appropriately be associated with such a frequent pine-barren form.

Dr. Sargent (Rhodora, 17, 1915) has called attention to the Linnean *Quercus rubra* being based on Clayton's specimen from Gloucester county, Va., which is the southern red oak (*Q. cuneata* Wang.), and not the

northern red oak.* Although the northern red oak occurs on the peninsula, it is infrequent, and is not separated locally from the black oak. If *Q. falcata var. b pagodæfolia* Ell. (Sk. 2, 605, 1824) is regarded as a variety of the southern red oak, it then becomes *Quercus rubra pagodæfolia* (Ell.) n. comb. If *Quercus triloba* Mx. (Fl. 2, 199, 1803) is considered a variety, it becomes *Q. rubra triloba* (Mx.) n. comb.

The first available name for the northern red oak would seem to be *Q. rubra maxima* Marsh (Arb. Am. 122, 1785). Lamarck's *Q. rubra a latifolia* appeared considerably later, although the title page bears date 1783. The northern red oak consequently becomes *Q. maxima* (Marsh). In case *Quercus borealis* Mx. f. (Silva N. A., 1, 115, 1817) is regarded as being only a variety, its name then becomes *Quercus borealis maxima* (Marsh.) n. comb.

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* Catesby's plate (23) cannot well represent the northern red oak, as Dr. Sargent suggests: the petioles are too short, the lower leaves nearly sessile; base of leaves too cuneate, lobes too falcate, and cup too deep. It is a fair representation, however, of *Quercus Catesbœi*, and is Michaux's reference for this species.

W. W. Ashe.

REVIEWS

The Testing of Forest Seeds [1]

Rafn has recently published in English for private circulation the results of his researches on the germination of forest seeds during 25 years, namely, from 1887 to 1912. This publication, in the opinion of the reviewer, is the most important contribution in this field that has appeared in English. Moreover, due to the large number of American species tested, it is almost of equal importance to foresters in this country as it is to those in Europe. Since the author began the testing of forest seeds, more than 25 years ago, when he entered the seed trade, frequent reports of his researches have been published in various Danish and German journals. Rafn has brought together in the brochure under review a summary of the data published in his earlier writings, together with much earlier material. The work is not only of great value to American foresters engaged in seed testing, but it will also be of great economic value to nurserymen in the United States who are engaged in growing forest trees from seed.

The tests were all made in the Danish apparatus known as the "Jacobsen germinating apparatus." Although most investigators make germination tests of tree seed under a covering of earth, as they are believed to give results more in accord with what may later be expected in the nursery and field, this can in no way detract from the importance of Rafn's results. The thousands of tests made during the entire period of investigation were on seed obtained from dealers and collectors in all parts of the temperate regions of the world. The tests are of especial interest to foresters in this country because of the large number of American seeds tested. In the presentation of this voluminous material the author pointedly remarks: "Only the foundation is laid, but we are now able to proceed regularly and systematically, so that by the end of another ten years we shall have made some real progress in the knowledge of the testing of forest seeds." The data are presented under the following heads:

(*a*) The European, West Asiatic, and North African conifers.
(*b*) American conifers.
(*c*) Japanese (East Asiatic) conifers.
(*d*) The seeds of broad-leaved trees.

[1] Rafn, Johannes. The testing of forest seeds during twenty-five years, 1887-1912. 1915. Printed for private circulation.

The presentation and discussion of the data under the above heads is followed by four comprehensive tables, which give for each species tested the number of samples, the lowest, highest, and average weight per thousand seeds, the average number of seeds per Kg. of pure seed, the lowest, highest, and average purity, the lowest, highest, and average germination capacity (germinated + sound seed), and the real value (purity × [germinated + sound seed]).

Complete records are also given of the course of germination, which expresses in a most satisfactory manner the germinative energy or rapidity of germination. Thus for each species there is given the lowest, highest, and average per cent of germination in 5, 10, 20, 30, 60, and 100 days, and for the more "rebellious" species in 100 to 400 days. The comprehensiveness of this work and the vast amount of labor involved in the tabulation are shown in the fact that more than 700 tests were made on 65 species of American conifers alone, or on nearly all of the indigenous species.

The detailed discussion of the results obtained in testing the different species brings out the great variation in the size of the seed from trees in different localities, and in general corroborates the view of Cieslar that the seed of a given species is usually smaller at the northernmost regions of its range and at high elevations. In the opinion of the reviewer, the larger sizes of the seed in one part of the range of the species over that in other localities is primarily due to available soil moisture during the period of germination. Thus the seed of Douglas fir is larger as we proceed south from Washington and Oregon to California, while western yellow pine and lodgepole pine seed is more than twice as large in California as it is in the northern Rocky Mountain region. The summer dry season of California makes it necessary for the young seedling to grow rapidly and produce a deep root system in order to resist the summer drought. The large seed with ample reserve of food stimulates rapid growth immediately after germination.

Great variation in the rapidity of germination in the seed of a given species from different localities is also strikingly brought out. Thus the seed of lodgepole pine from the Rocky Mountains germinated much more quickly and evenly than the seed of the same species from California.

The great variation that the author found in germination values of commercial seed of the same species was undoubtedly due in many instances to the reduction of viability through methods of seed collection and seed storage. It is reasonable to expect that with more care given to the collecting and storage of forest seed these extreme germination values within the species will become less. The tests on European species, how-

ever, in which it is to be presumed that more care was given to seed collecting and storage, show wide variations in germination values, but not so wide as in American species. It appears, therefore, that no matter how much attention is given to seed collection and seed storage the market price of forest seed should never be based upon volume or weight. Rafn states that the aim must be to sell forest seed according to the price per pound of real value and not per pound of material.

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A DISCUSSION OF LOG RULES—THEIR LIMITATION AND SUGGESTIONS FOR CORRECTION [1]

Among the confusing medley of rules and discussions regarding the measurement of logs in terms of sawed lumber, Mr. McKenzie has struck a clear note in this logical presentation of the subject from the mathematical standpoint. If for no other reason, this bulletin deserves recognition as the most lucid analysis of the mathematical relationships between the values of the solid content, waste, sawdust, and squared lumber that has yet been published; and, furthermore, it offers a flexible rule which may be adjusted to fit any local conditions. From the commercial standpoint, however, it may be questioned whether the flexibility of an adjustable rule, such as the one derived by Mr. McKenzie, is a desirable feature, rather than a fixed value, such as is possessed by a number of rules already in use which conform in an approximate manner to the correct mathematical principles. Commercially it is unimportant what rule is used, provided that it be correctly constructed as applying to *board feet* and not to cubical *volume,* and that it be a rule which is well known to both buyer and seller. In fact, it may be a decided disadvantage to adopt an adjustable rule in commercial transactions. Both parties in the contract will know, to a sufficient degree of accuracy, what overrun or underrun may be expected from a well-known fixed rule and the conditions of sale adjusted accordingly, and the degree of saving by careful sawing will be wholly a matter to be determined by the sawmill man.

Some fourteen years ago the writer worked out a simple rule which has evidently been overlooked by Mr. McKenzie. This rule was derived by a mathematical analysis of many measurements taken at a number of sawmills in Maine in 1902. The results, with a discussion, were published

[1] Bulletin 5. California State Board of Forestry, 1915, by Herman E. McKenzie.

in the Proceedings of the Society of American Foresters in 1910, "The Log Scale in Theory and Practice," and the formula derived is simply

$$B = \frac{L}{16}\left(\frac{3}{4}D^2 - 2D\right)$$

where D is taken at the middle of the logs. It may be of interest further on to follow a comparison of the two rules.

First, let us examine the McKenzie rule and his analysis. In the introduction he rightly says:

"The only logical way of constructing a log rule which will be flexible and which will adjust itself to universal conditions is to so construct it that the underlying, fundamental principles are so segregated as to make them independent of one another, and to have them so worked together as to give the aggregate result of all factors, which will be in all cases proportional and equal to the volume of the manufactured product."

These fundamental principles as embodied in the rule are slab waste, sawdust, thickness and width of lumber. The *taper* of the log is not included in the formula, but is treated as an extraneous factor to be considered in making up a table of values. To quote further:

"Since the waste allowance which should be allotted to slabs should be proportional to the barked area, it can be met by reducing the diameter of all-sized logs a constant amount, and the remaining volume can then be considered as lumber plus sawdust. . . . The sawdust allowance depends upon the dimensions of the lumber to be sawed and upon the width of the saw used. . . . For any specific width of saw kerf and dimensions of lumber to be sawed, the allowance for sawdust should be a definite per cent of the total volume of all logs, not including slabs."

This sawdust factor or coefficient he gives as follows:

$$\frac{k\,(w+t+k)}{(w+k)\,(t+k)}$$

which represents the fractional part of the log lost in sawdust after slab allowance is made.

An assumption is made that loss due to "normal crook" varies the same as the slab waste, namely, in proportion to the surface or "barked area," as he expresses it, and that excessive taper in small logs can be offset by a constant.

The complete formula expressed in mathematical terms thus becomes the following:

$$B.\,M. = \left[1 - \frac{k\,(w+t+k)}{(w+k)\,(t+k)}\right]\frac{\pi\,(D-a)^2}{48}L + C$$

Assuming the following values:

$k = 1/8$ inch saw kerf.
$W = 12$ inches, average width of lumber.
$t = 5/8$ inch, average thickness of lumber.
$a = 1$ inch (= deduction for slab and crook loss).
$C = 2$ = constant for excess taper in small logs.
$L = 16$ feet = length of log.
D = diameter small end inside bark.

This formula becomes:

$$B.M. = 0.942\ (D - 1)^2 + 2$$

Under the heading "A Comparison of Three Different Types of Log Rules" he makes the statement: "There are three distinct types of log rules now in general use. . . . (*a*) Rules with a waste allowance varying directly as the barked area of the log and the volume of the log after the barked area allowance is made." (This is the true *board-foot rule,* as I have pointed out in my article referred to above.) "(*b*) Rules with a waste allowance varying directly as the total volume of the log alone. (*c*) Rules with a waste allowance varying directly as the total volume of the log plus a constant." (The latter two I have classed together and designated as *volume rules.*) It is possible to convert the aggregate value of the scale of a lot of logs measured by any rule of one class into the value which would result had they been measured by another rule of the *same class;* but "if it is desired to reduce the aggregate scale of logs now expressed in standards (class *b*) to board feet, as shown by the Doyle rule (class *a*), for instance, the problem is impossible. There is no way of making the reduction. . . . If only a single log were in question instead of a number of different sizes, it would be very easy to make such a reduction; but since there is no common ratio existing between (these two rules) for logs of all sizes, the reduction cannot be applied to more than one log or set of logs of equal diameters." "The three distinct types of rules . . . can have no common reducing factor for logs of different sizes, since the underlying principles are not the same."

This is a fact often overlooked and is well brought out. In this chapter Mr. McKenzie classifies all of the known log rules according to the three distinct classes given above and has expressed them in mathematical equations of the three respective forms.

A table has been worked out for logs varying from 4 to 120 inches in diameter at the small end and for lengths of from 8 to 32 feet, allowing a taper of 1 inch in each 8 feet in excess of 16-foot lengths. Illustrations of the manner of adjusting the McKenzie rule to local conditions existing at any mill is given in an appendix.

The bulletin is illustrated by curves and diagrams.

In regard to the practical correctness of some of the assumed "fundamental factors" some question exists. It seems improbable that the slab allowance should be considered to vary with the surface or "barked area," since the segment of the circle cut off in slabbing a small log has a greater proportional volume than in a large log, on account of the greater curvature. That losses due to crooks should be in direct proportion to area is a pure assumption, but perhaps reasonably correct. It will be noticed that when the diameter $= a$ (or 1 inch) the equation gives a positive value of C (or 2 board feet), and that when it becomes zero the value increases. In other words, the curve intersects the zero diameter ordinate while it is still on the positive side of the board-foot ordinate. In actual practice this would not be the case, but rather the reverse, and a log of 4 inches or less in diameter would yield no lumber. This is due, in part, to a factor not taken into consideration in this rule, namely, the width of the narrowest board accepted commercially. I have found that in practice the log rule should give a zero value, with a diameter of about 3 inches in the middle or 2 inches at the small end of a 16-foot log.

In comparing the McKenzie rule with the one which I worked out from mill measurements, it is of considerable interest to note how closely they agree in form, which lends confidence to both rules, although the McKenzie rule gives higher values and applies to more careful sawing conditions. Since my rule applies to the middle diameters and his rule to the small ends, an exact comparison can only be made by assuming a definite taper. A taper of 0.8 inch was determined for a length of 8 feet from my measurements, and the rule applies for a saw kerf of 3/16 inch and a thickness of lumber of exactly 1 inch.

Using these values for the McKenzie rule gives for 16-foot logs

$$.868d^2 - 1.736d + 2.868 \text{ (McKenzie)},$$

as compared to

$$.75d^2 - 0.8d - 1.12 \text{ (Tiemann)},$$

derived thus: $\frac{3}{4}(d + .8)^2 - 2(d + .8)$.

Taking a few diameters by way of numerical comparison, we have the following values in board feet:

d.	McKenzie.	Tiemann.	Actual mill cut in Maine.	Holland.
6	23.7	21.1	20	20
10	72.3	65.9	64	68
15	172.2	115.6	154	157
20	315.4	282.9	292	295
30	732.0	649.9	...	....

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Tree Studies [1]

These six bulletins form a notable addition to the forest literature of the United States. Strictly speaking, the Cypress and Juniper Bulletin is a botanical study; the Lodgepole Pine, a management study; the Northern Hardwood Forest, a regional study, and the Ashes, a genus study. This leaves the Southern Cypress as the only strictly complete commercial tree study, because the Life History of Shortleaf Pine contains no volume data or management instructions. A review of these bulletins indicates that the Forest Service is making distinct strides in its scientific work. The reason is simple: it is because mature men are specializing. Frequently in the past Forest Service bulletins were published by executive officers who could not devote their entire time to scientific or literary pursuits. There are exceptions, of course. The very reason why No. 234 is a strong bulletin is because it is the product of administrative and field experience.

Students of forestry would do well to study the outlines which have been summarized in the table which follows:

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[1] Department of Agriculture Bulletins, contributed by the Forest Service: "The Cypress and Juniper Trees of the Rocky Mountain Region," by George B. Sudworth, Bulletin No. 207; "Utilization and Management of Lodgepole Pine in the Rocky Mountains," by D. T. Mason, Bulletin No. 234; "Life History of Shortleaf Pine," by Wilbur R. Mattoon, Bulletin No. 224; "The Southern Cypress," by Wilbur R. Mattoon, Bulletin No. 272; "The Northern Hardwood Forest: Its Composition, Growth, and Management," by E. H. Frothingham, Bulletin No. 285; "The Ashes: Their Characteristics and Management," by W. D. Sterrett, Bulletin No. 299.

The Cypress and Juniper Trees of the Rocky Mountain Region.	Utilization and Management of Lodgepole Pine in the Rocky Mountains.	Life History of Shortleaf Pine.
GEORGE B. SUDWORTH.	D. T. MASON.	WILBUR R. MATTOON.
Scope of the bulletin. Class and family relationship of cypresses and junipers. Generic characteristics of cypresses. Arizona cypress. Smooth cypress. Generic characteristics of junipers. Common juniper. Western juniper. Mountain red cedar. One-seed juniper. Mountain cedar. Utah juniper. Knight juniper. Big-berried juniper. Alligator juniper. Drooping juniper. Key to species.	Ownership and supply. Characteristics of the wood. Uses. Fire-killed timber. Size and contents of various products. Annual cut. Methods of lumbering. Costs and selling prices. Charcoal-making. Management of lodgepole stands. Rotation. Methods of cutting. Brush disposal. Regulating the cut. Reforestation. Protection. Summary. Appendix — Volume tables.	Name and identification. Geographical and economic range. Character of stands. Size, age, and habit. Demands upon soil and climate. Light requirements. Reproduction. Growth. Causes of injury. Yield.

The Southern Cypress.	The Northern Hardwood Forest: Its Composition, Growth, and Management.	The Ashes: Their Characteristics and Management.
WILBUR R. MATTOON.	E. H. FROTHINGHAM.	W. D. STERRETT.
Importance. Geographical and commercial range. Present supply and annual cut. Properties of the wood. Uses. Cypress lumbering. Markets and prices. Stumpage. Life history of the tree. Cypress stands. Forest management. Appendix.	Introduction. The northern hardwood forest. Topography and climate. Composition. Form. Growth. Second growth. Economic importance. General utility. Annual cut. Present supply. Value of standing timber. Management. Place of northern hardwoods in forest management. Species mentioned in this bulletin. Appendix.	Importance. Lumber cut. Use by industries. Groups and species. Silvicultural significance. Relative importance of species. Occurrence. Soil, moisture, and light requirements. Reproduction. Injuries. Form and development. Yields. Value of standing timber. Forest management. Rotation. Species for timber growing. Natural *vs.* artificial reforestation. Reforesting by natural means. Reforesting by artificial means. Thinnings. Summary. Appendix.

The foregoing table shows at a glance the contents of these bulletins. Excellent changes which have been made in the form of the Department of Agriculture publications since Secretary Houston has taken charge, although it is not altogether clear why some bulletins—as, for example, No. 234—is entitled "Professional Paper," while Bulletin 272 is not. The table of contents is printed on the cover, and fairly complete footnotes and acknowledgments are now given, whereas formerly the editors eliminated them from the manuscript. For example, the manuscript of Forest Service Bulletin 101, "Western Yellow Pine in Arizona and New Mexico," contained exceedingly complete footnote acknowledgments and references. Much to the disappointment of the writer, these were almost entirely eliminated upon publication. It is felt that even more complete acknowledgments could properly be given. Much of the data upon which these bulletins were based has been collected by a number of men in years past. It seems to me the scientific value of the statistics would be increased if it was specifically stated (*a*) who collected the data, (*b*) when it was collected, (*c*) where it was collected. It is quite creditable to note the minimum of printers' errors which have crept into the final proof. Such errors as that on page 54 of Bulletin 272 are very unusual. Former bulletins have been criticised because they read as if they had been poured out of one literary mould; this is less evident than it used to be, although evidently they have been carefully edited. It seems to be customary to divide the growth data into maximum, average, and minimum; I am not certain that this means a great deal to a professional forester. It merely gives for the data collected (and there appears to be no scientific basis to govern the *location* and collection of growth data) maximum, average, and minimum results. Would it not be preferable and altogether feasible to group the data according to the tree-crown classes and upon a classification of the soil and climatic conditions? It is quite typical of Forest Service bulletins to show differences in growth in different States. Obviously, the growth of a species does not change simply because the tree is growing in Vermont or in New Hampshire. The growth varies because of differences in soil, situation, altitude, growing season, and because of variations in climate, taken in the broadest sense. The very fact of these differences in growth in the different States is often part proof of the chance collection of growth data, except where the climatic factor is clearly predominant. Now that the investigative work of the Forest Service is being placed upon a scientific basis, there is all the more need for "systematic silviculture." Some feel that, in the haste to publish, the Forest Service has skimped its growth data. A larger number of measurements may be de-

sirable. Unfortunately, some of the data collected prior to 1912 is of questionable scientific value.

Another problem which must be solved is whether it is advisable to repeat again and again descriptions of the selection system, the shelterwood system, the group system, etc., as applied to the various species. While this repetition tends to drive home the management principles, yet it unquestionably is an added burden in publication which might be obviated. This difference is very noticeable in comparison with European "tree studies." In Europe the author presupposes that his readers understand what the different systems are, and considers it sufficient to say what systems are suitable to the species; he only describes in detail variations from the standard systems. In this country, where the systems are not so well understood, standard descriptions of each cutting system might be given in the appendix in small type, then the author could follow the European method in describing methods of cutting. While it is true that these publications are better[2] than the average European publications of the same class, it must be realized that, so far as I know, foresters abroad publish tree studies as an adjunct to their professional work instead of spending their whole time upon the collection of data and its compilation. It must be apparent to every one that it will soon be advisable for the Forest Service to publish a bulletin summarizing the silvical characteristics and management of the commercial species of the United States; such a publication would be eagerly sought for by European foresters. It is a pity commercial tree studies are not revised and reprinted. Such a bulletin as Mason's Lodgepole Pine should be of wide value to the district if it were only periodically revised. It is already out of date in brush disposal.

In the foreword to the Cypress and Juniper Bulletin, Sudworth states:

"This bulletin describes distinguishing characteristics, geographical distribution, and forest habits of all the known species of cypress and juniper growing in the Rocky Mountain region."

The material is admirably presented and is a distinct contribution to forest botany.

Why are not botanists more interested in regeneration? It is a problem which they should be able to study with profit. A thorough study of this bulletin emphasizes that these species are forced to the dry and less desirable locations, and that many of them are fighting for their existence. Knowing this, *the avowed policy of the Forest Service in eliminating*

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[2] It would be interesting to learn the actual cost of some of these bulletins. It is hardly fair to compare a bulletin costing perhaps $3,000 with an European monograph that costs $300.

from National Forests large areas of the "woodland type" in order to reduce the cost of administration should be disapproved by the profession. There are probably from two to five million acres of woodland in Arizona and New Mexico which, in my opinion, should be conservatively administered and protected.[3] *To justify its present policy of elimination, the Forest Service should certainly have most conclusive data. This data has never been given to the public.*

Mason's Lodgepole Pine, Utilization and Management, is perhaps the strongest tree bulletin published by any Western administrative officer. The tables are conveniently arranged, are practical and complete. Table 6, for example, giving data on stulls, is unique. The cost of production figures (pp. 15-18) are ahead of anything that has been in print. Under the objects of management, he recognizes water protection as paramount to a maximum sustained yield of merchantable timber. There is grave doubt, however, whether (upon the basis of the data given) the rotation of 140 years is correct. Without field study, and judging solely from the material presented, it would appear that a rotation of 100 to 120 years or even less is more likely the ideal rotation for the lodgepole pine under management. Present stands are notoriously crowded. With suitable thinnings (which are provided for in National Forest cuttings), it seems to me that more rapid diameter growth is assured. With this more rapid growth, it will be possible to reduce the rotation below 140 years. Generally speaking, the shorter the rotation (within reason) the less fungus disease and the higher financial returns. The official marking rules quoted (pp. 25-28) are exceedingly complete. It is of passing interest to note that the ideal number of sound trees to leave per acre, given as 320 under paragraph (3), "Immature—Improvement Thinning" (p. 27), is considerably more than Schwappach gives in his yield table for second quality Scotch pine 100 years old. The cost of brush disposal (p. 34) is considerable. It will certainly be advisable to determine whether a modification in complete brush disposal is not feasible. The profession is coming to realize that the Forest Service is wasting thousands of dollars in ill-advised and too intensive brush piling and scattering. Mason's brush data is already out of date. Under regulating the cut (p. 35) there is much interesting data. The only query is whether such intensive regulation is necessary at this stage of the game. Evidently, the determination of the cut in this case involved the expenditure of a great deal of money at a period of our management history when many forests

[3] In Tunisia the French have an intensive form of administration for the valuable cork-oak forests and a far cheaper extensive one for the "scrub" pine (*Pin d'alleppe*).

lacked rough stock-taking. To predict the cut so far ahead—"the method of volume regulation (Table 19) calls for a moderate cut on the division for 100 years . . ." appears to me unusual. This is more intensive than is customary in European practice.

Mattoon's Shortleaf Pine illustrates a number of original methods of presenting data (as, for example, pp. 10, 15, 16, 21, 32). On the other hand, he gives as facts in connection with the species a good many points which are known to be true for all species—as, for example,

"The relation of the density to the quality of situation, both in one locality and in widely separated regions, appears to be constant and regular."

In Table 5 he uses the classification "under-stocked," "well-stocked," and "over-stocked." Perhaps this could be improved upon. It would be interesting to learn why no volume tables or data on management were included in this bulletin.

The Southern Cypress, also by Mattoon, is a stronger publication than his Shortleaf Pine. Here, again, he presents data very graphically (for example, the figures on p. 22 and Plates IX, X, and XI). The cypress has always interested me because it grows on the best of agricultural soil if only the water could be drained off. Mattoon's discussion (pp. 51-53) of the cost and difficulty of draining is interesting and was summarized from an excellent source—U. S. Senate Document 443, 60th Congress. The problem of the future use of these lands is clearly presented and his conclusions (p. 50) seem sound. He frankly admits regeneration by seed is difficult and clear cutting usually desirable. He might have emphasized even more the extreme difficulty of reproducing future stands. It would be of extreme interest if the idea presented by Prof. Ellsworth Huntington in his "The Climatic Factor" could be applied to cypress height and diameter growth. The results would have an important bearing on the question of variation in rainfall as told by tree growth. If similar periodic variations in cypress growth were found comparable to the giant redwood, then one might deduce that other factors of climate rather than rainfall had more to do with slow or rapid tree growth, inasmuch as cypress trees presumably can always obtain sufficient water.

Frothingham's "The Northern Hardwood Forest" is a praiseworthy publication; the arrangement of the material is convenient; it unquestionably was exceedingly difficult to compose, so as to give the proper perspective. For hardwoods, the kind of diagrammatic marking rules given by Fisher and Graves to illustrate woodlot marking seem preferable to those quoted (pp. 42-44). It will be interesting for students of forestry to compare the management by Frothingham with that by Hawes and

Hawley in "Forestry in New England." Frothingham is to be congratulated on an exceedingly complete appendix containing more than the usual volume data.

In "The Ashes" Sterrett has clearly differentiated between the species. The bulletin is unusually complete. The variation in yield per acre between the different soil qualities, given in Table 15, is surprising. For example, on quality 1 at 40 years of age the yield is 11,700 board feet; on quality 2, 5,300, and on quality 3, 1,300. Could not this variation be due to the fact that the data for quality 3 was based on very poorly stocked stands, although, judging from the number of trees per acre, this was not the case? The quality 3 soil, however, is apparently quite remarkable in that at 80 years it shows a yield of 18,000 feet per acre—a growth of 18,000 less 1,300, or 16,700 feet in 60 years. One can hardly believe such figures. Should not this data have been checked before publication? The crown pictures are interesting, but for forestry purposes crown diagrams drawn to scale seem preferable. It is gratifying to see in this bulletin and in other recent tree studies such complete data on the width and length of crowns. Sterrett presents a very complete appendix and interesting *tabular summary,* which authors might imitate with decided profit.

THEODORE S. WOOLSEY, JR.

ALBUQUERQUE, N. MEX., *February 1, 1916.*

THE RÔLE OF ASPEN IN REFORESTATION [1]

This article is the result of an investigation conducted at the Fort Valley Experiment Station to determine the effect of a cover of aspen (*Populus tremuloides*) upon the establishment of Douglas fir (*Pseudotsuga taxifolia*). The greater portion of the burns occurring in the Douglas fir and Alpine types in Arizona and New Mexico are aspen-covered. These burns are restocking satisfactorily only where scattering trees of the original forest are present or the burn is comparatively small. If sufficient seed trees are present, Douglas fir, white fir (*Abies concolor*), Engelmann spruce (*Picea engelmanni*), and Alpine fir (*Abies lasiocarpa*), because of their tolerance, thrive under the shade of the aspen. These species eventually overtop and kill the intolerant aspen, re-establishing the original forest type. Artificial regeneration is considered only for those burns that are not restocking naturally.

The survival and condition of Douglas-fir stock planted in aspen

[1] Pearson, G. A. "The Rôle of Aspen in the Reforestation of Mountain Burns in Arizona and New Mexico." The Plant World, 17: 249-260, 1914.

thickets was compared with the same kind of stock planted in similarly situated open areas. This comparison was supplemented by a study of the physical factors of the two sites. The aspen thickets support a luxuriant growth of broad-leaved mesophytic and somewhat succulent plants, such as *Frasera scabra, Pteridium aquilinum,* and *Verbascum thapsus,* while grasses (*Muhlenbergia gracilis, Festuca arizonica, Festuca pseudovina,* and *Bromus polyanthus*) predominate in the openings. The growth of all herbaceous plants is invariably more luxuriant under the aspen than in the open. The planting under aspen showed a survival of approximately 13 per cent more than that in the openings. The dead and injured plants in the open showed indications of having suffered from drought.

The maximum solar radiation, as determined by means of thermographs, averaged approximately 8 to 9 degrees higher in the openings than under an aspen cover. The actual soil-moisture determinations revealed only slight differences between the two planting sites, due to the absence of a constant, such as the moisture equivalent or wilting coefficient, by which to compare the available growth water. The greater humus content of the soil under aspen apparently should increase its water-holding capacity, causing a greater moisture content at the close of the spring thaws, which is the time of the inception of growth. The wind movement was approximately twice as great in the open as under an aspen cover. The evaporating power of the air was 60 to 90 per cent greater in the open. The decidedly better success of the planting under a nurse crop of aspen is almost wholly attributed to the decreased evaporation and the consequent reduction in transpiration. This principle is evident in forest nurseries, in that the loss of plants is prevented if partially shaded for a time, thereby preventing excessive transpiration. Incidentally attention is directed to the importance of vegetative reproduction in the establishment of aspen by means of root suckers.

The study has proved conclusively that, other conditions being equal, aspen-covered areas are more favorable planting sites for tolerant species like fir and spruce than open areas at the same elevation. Western yellow pine (*Pinus ponderosa*) will doubtless, because of its lower moisture requirements and greater intolerance, be more suitable for reforesting open areas within its natural range. Aspen-covered areas of the Douglas fir and Alpine types can be reforested successfully with Douglas fir and Engelmann spruce respectively. Bristlecone pine (*Pinus aristata*) is recommended for planting in openings at the higher elevations, where Engelmann spruce fails.

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Clarence F. Korstian.

SOCIETY AFFAIRS

Annual Meeting of the Society of American Foresters

The annual meeting of the Society of American Foresters was held on January 22, 1916, in Washington, D. C. The first session was held in the National Museum and was called to order at 10.40 a. m. by the President, Mr. Greeley. Mr. Dana was appointed Secretary *pro tem.*

The report of the President for the past year was presented by Mr. Greeley. The report was not discussed because of the fact that his suggestions were all covered by specific recommendations of the various officers and committees, to be presented later.

The report of the Secretary was presented by the Acting Secretary, Mr. Murphy.

The report of the Treasurer was presented by the Treasurer, Mr. Murphy. His suggestion regarding the disposal of back numbers of the Proceedings of the Society was referred to the Executive Committee with authority to act. Mr. Greeley stated that he presumed this reference to the Executive Committee would be with the understanding that the general policy of disposing of these back numbers by a sufficient reduction in price to make them salable was approved. Mr. Zon suggested that it would be desirable to adopt some less complicated method of disposing of back numbers than that suggested by Mr. Murphy. Dr. Fernow felt that the price of back numbers should be increased rather than reduced, in order to retain a supply from which future members might complete their file of the Proceedings.

The report of the Executive Committee was presented by the Chairman, Mr. Stuart. After an extended discussion the meeting indorsed the following recommendations of the committee on the amalgamation of the Proceedings of the Society and the Forestry Quarterly:

1. That an amalgamation of the Proceedings and the Forestry Quarterly be made, whether or not an increase in dues is necessary to accomplish it.

2. That the plan of control of the combined publications conform to that given for the Proceedings in the present Constitution of the Society (Article V, section 5), subject to amendment as to the number of members on the Editorial Board, upon the recommendation of the Board after organization.

3. That the details of publication and policy of the journal be left with the Editorial Board.

On motion by Mr. Dana, the meeting expressed itself as in favor of an increase in dues for Active members from $3 to $5 per year. On motion by Mr. Dana, the meeting also expressed itself in favor of levying no dues on Associate members and at the same time of ceasing to send them the Proceedings of the Society except on special subscription. All of these matters were referred to the Executive Committee for its action and later reference to letter ballot by the entire Society.

The recommendation of the Executive Committee that no steps be taken by the Society to incorporate was indorsed. The recommendation that the budget system adopted last year be continued was also indorsed.

Dr. Fernow moved that the recommendation of the Executive Committee, that the matter of indorsing the Federal Migratory Bird Law be referred to the entire membership for letter ballot, be amended to provide for the indorsement of this law by the present meeting. The motion was agreed to and the law thereby indorsed without further action.

The recommendation of the Executive Committee regarding the election of women as members of the Society was referred to the Executive Committee for consideration in connection with other membership matters.

The meeting adjourned at 12.35 p. m. until the conclusion of the open meeting, to be held early in the afternoon.

An open meeting of the Society was held in the National Museum at 1.15 p. m., at which the following papers were presented: "The Possibilities of Silviculture in America," by Dr. B. E. Fernow, and "Vegetation Zones of Argentine and Adjoining Regions," by Dr. Cristobal Hicken.

The adjourned business meeting of the Society was called to order again in the National Museum at 3 p. m. by the President, Mr. Greeley.

The report of the Editorial Board was presented by the Editor-in-Chief, Mr. Zon. The meeting expressed its approval of the recommendation of the Board that a change be made in the name of the Proceedings and referred the matter to the Executive Committee for consideration in connection with the amalgamation of the Proceedings and the Forestry Quarterly.

The report of the Committee on Admissions was presented by the Chairman, Mr. Clapp. The meeting indorsed the recommendation of the committee that the creation of a new class of members, to be called "Fellows," is undesirable for the present at least. The proposal of the committee that a new class of members, to be known as "Junior" members,

be created was discussed at considerable length. A motion by Dr. Fernow that the Junior membership should be composed of men who are graduates of a forest school with one year's experience was lost. On motion by Mr. Dana, the meeting expressed its approval of the creation of a new class of members, to be composed of professional foresters whose achievements are not sufficient to make them eligible for Active membership, the details to be worked out by the Executive Committee and submitted to the entire membership for letter ballot. A motion by Mr. Ashe that this new membership class be known as "Members" was lost. On motion by Mr. Stuart, the meeting expressed itself in favor of retaining the name "Active" member for the present Active membership of the Society, and of designating the new membership class by the term "Junior" or some other appropriate title. On motion of Mr. Zon, it was voted to refer the question of the privileges of Junior members to the Executive Committee.

The recommendation of the Committee on Admissions, that the period now required by the Constitution for the publication of the names of proposed members be reduced from two months to one month, was indorsed by the meeting, together with the suggestion by Mr. Zon that the names of proposed members be published in the Proceedings of the Society rather than in a separate printed list. Mr. Zon also suggested that the proposed circular dealing with election to membership be printed in the Proceedings.

Mr. Silcox moved that the meeting express its approval of an arrangement by which Junior members would automatically become Active members after a certain period of years and refer the matter to the Executive Committee for appropriate action. Considerable discussion ensued, but the motion was not seconded.

The report of the Committee on Meetings was presented by the Chairman, Mr. W. L. Hall.

The report of the Committee on Terminology was presented by the Chairman, Dr. Fernow.

The report of the special committee on the establishment of a section in Washington was presented by the Chairman, Mr. Peck. After some discussion the recommendation of the committee that such a section be established was indorsed and the desirability of holding as many general meetings of the Society as possible was emphasized. The meeting also expressed its approval of the publication in the Proceedings of the programs of meetings held by all of the Sections of the Society.

The report of the special committee on a Society emblem was read by the President, Mr. Greeley.

Mr. Clapp spoke of his attendance recently at the annual meeting of the American Association for the Advancement of Science. He recommended that the Society adopt the policy of holding a meeting of the Society in connection with the annual winter meeting of the Association for the Advancement of Science as often as practicable, and that the program be arranged in time so that it might be printed with the rest of the Association program. His recommendations in these respects were indorsed by the meeting.

The result of the recent election of officers was announced by the Acting Secretary, Mr. Murphy, as follows:

President, B. E. Fernow.
Vice-President, E. H. Clapp.
Secretary, Findley Burns.
Treasurer, S. T. Dana.
Executive Committee:
W. B. Greeley (5-year term).
R. C. Bryant (4-year term).
Clyde Leavitt (3-year term).
D. T. Mason (2-year term).
F. A. Silcox (1-year term).

The President elect, Dr. Fernow, then took the chair and spoke briefly.

The meeting adjourned at 5.35 p. m. on motion of Mr. Stuart.

In the evening a smoker, attended by 67 members and friends of the Society, was held at the University Club, at which a number of informal talks were given.

S. T. Dana,
Secretary pro tem.

Active Members Present at the Business Sessions of the Annual Meeting of the Society, January 22, 1916

W. W. Ashe
J. St. J. Benedict
E. S. Bryant
Findley Burns
E. E. Carter
H. H. Chapman
E. H. Clapp
E. D. Clark
P. T. Coolidge
W. T. Cox
S. T. Dana
Rudolph Dieffenbach
I. F. Eldredge
B. E. Fernow
John Foley
E. H. Frothingham
W. B. Greeley
R. C. Hall
W. L. Hall
R. S. Hosmer

Francis Kiefer
Benton MacKaye
W. R. Mattoon
T. T. Munger
L. S. Murphy
A. S. Peck
J. G. Peters
F. A. Silcox
C. S. Smith
W. D. Sterrett
R. Y. Stuart
C. R. Tillotson
E. A. Ziegler
Raphael Zon

Report of the President for 1915

January 21, 1916.

The significant feature of the Society's work during the past year has been its continued expansion into more truly a nation-wide organization, or indeed continent-wide, and a correspondingly closer identification with the diversified forest interests and activities of the North American countries. The proportion of our members who are in the United States Forest Service is decreasing, the percentage now being 53. This is entirely as it should be. The Society should be identified with the foresters engaged in State, commercial, or educational work, just as fully as those employed by the Federal government; and the increasing number of men engaged in these lines of forest work should be reflected in an increasing proportion in the membership of the Society. It has been my chief desire during my year's work as President to do everything possible to promote this development of the Society as an organization which represents and is in touch with all of the diverse forest interests of the continent. That we now have 11 members from the Dominion of Canada is further indication of the kind of growth in keeping pace with the development of forestry in North America which I believe the Society should strive for.

An important feature of this development has been the establishment of additional local Sections. Two new Sections were organized during the year and approved by the Executive Committee, embracing the central Rocky Mountain region and the Southwestern States respectively. This brings the total number of local Sections up to five. It is probable that an additional Section will be established in California, which contains 32 Active members of the Society, in the near future. I have given special effort to this matter during the year and I commend it particularly to the officers who will have the work of the Society in immediate charge during the ensuing year. The interests and problems of American foresters are probably localized to a greater degree than those of almost any other profession. To identify the Society with these interests and problems

effectively, it, too, must be localized. The local Section is, I believe, the logical and effective means of filling this need. Our membership rolls indicate that there are enough Active members in several other States, or groups of adjoining States, to support effective Sections. I hope that this identification of the Society with local forestry interests may be extended materially through the establishment of new Sections or, what will accomplish practically the same objects, the affiliation of local organizations of foresters already existing.

In pursuance of this plan of nationalizing the work of the Society as far as may be possible and of putting its members throughout the length and breadth of the continent on the same footing, I would urge the special consideration by the members residing in Washington of the establishment of a local Section at this point, handling its meetings and other affairs in the same manner as the local Sections elsewhere. Such action would aid in identifying the parent Society with the entire country rather than with any particular region or group of members. This matter will be presented later by a special committee.

Another important phase of extending the work and influence of the Society is the holding of occasional meetings at various points throughout the country, particularly in connection with other organizations having associated interests. The very successful meeting held during forestry week at the Pan American Exposition, which was largely attended by foresters, forest educators, and lumbermen from the western portion of the country, was a further step in the application of this policy. I believe that such meetings should be annual features of our work. A suggestion will be offered later in regard to meetings with the American Association for the Advancement of Science which would be in direct line with this policy.

Another important question which is involved in the expansion of the Society and of its contact with the varied phases of forestry work in our domain is that of membership. This matter has been considered very carefully during the year by the Committee on Membership and will be covered fully in its report. I wish at this time simply to suggest the importance of the Society's determining upon a basis for membership which will permit the association with us of the various classes of men whose interest and support the Society needs, but without lowering our standards of qualifications for full membership.

I do not wish to create any impression from the foregoing that expansion of the Society's work in the matters of public meetings and membership are the only important features of its work which merit your special consideration. These developments would be indeed of little value

if they were not accompanied by a corresponding development in the amount, character, and standing of its technical work. I wish to refer briefly to two subjects under this heading.

The first is the high standard obtained by the Proceedings of the Society. The continued publication of this journal, now established on the basis of four issues per year, with an enlarged circulation and with sustained high technical standards, represents the most worth-while thing which the Society has done or can in all probability continue to do. I feel that very great credit is due to Mr. Zon and his associates on the Editorial Board for the character of the Proceedings, and I wish that some special action might be taken by the Society in recognition of Mr. Zon's long-continued and exceedingly efficient handling of this very important phase of our activities. During the past year the Proceedings have become entirely self-supporting, for the first time in their history. I would suggest that, both to extend their circulation and to further strengthen their financial footing, special measures be considered (1) to promote the sale of additional copies through regular subscriptions or otherwise, and (2) to include a limited amount of dignified advertising matter, with reference especially to forestry literature and forest schools. I would also suggest that a change in title to "The Journal of Forestry" be considered, coupled with a statement that the Journal is the official organ of the Society of American Foresters, in order to indicate more accurately the character of the material which is published and the real place taken by this publication among the periodicals of the country. In suggesting this name, I have had in mind the avoidance of duplication or confusion with the titles of other publications, particularly "American Forestry."

The scientific and technical interests of the Society center very largely around the development and character of its Proceedings. Material is available for a considerable expansion in the amount now published annually. The development of the Proceedings into a sphere of increased usefulness, however, can only keep pace with the development of the Society and the financial backing which the Society gives to this publication. I hope very much that it will be possible to see further developments in this direction, particularly in the publication from time to time of more extended and comprehensive articles of a scientific character, either as special numbers of the Proceedings, or Journal, or as a separate series of bulletins of the Society. I feel that our organization has reached the point where it should begin the publication of scientific material of this character which becomes available to it from time to time; and I suggest that this development of our technical work, under

the supervision of the Editorial Board, be considered in our consideration of finances and allied questions.

The Executive Committee has had under consideration during the year the amalgamation of the Proceedings of the Society with "Forestry Quarterly." Its report will deal with this matter. There are many reasons which commend it to the favorable consideration of the Society. It is, of course, important that in the event of such an amalgamation the new journal or publication continue to bear a relationship to the Society of American Foresters in the organization of its work and the policy governing it similar to that which the Proceedings now holds. This is, I am sure, the desire of Dr. Fernow and all of the others interested in the amalgamation.

The second activity of special moment in the technical work of the Society to which I wish to refer is the consideration and study of questions of nomenclature and terminology, the standardization of scientific methods, and the assembling of technical information on subjects not covered adequately by other agencies. This work was given an admirable start by my predecessor, Dr. Fernow, through the appointment of a Committee on Terminology, with five subcommittees. I have been happy to be able to continue this work under the direction of the same members of the Society who initiated it and with Dr. Fernow, as chairman of the committee, to give the work central direction. The labors of the committee and the character of its results will be presented to you in a special report from its chairman. This represents, to my thinking, the kind of activity which the Society should undertake with more and more vigor in the future; and its organization and finances should be considered with this object in view. Dr. Fernow also proposed during his incumbency the designation of a committee on technical investigations and standard practice. It was my feeling that it might be inadvisable for the Society to attempt too many projects of this character simultaneously or to launch too extended a program until we had tried out our ability to handle projects of this character as an organization. It seemed to me, therefore, that during the past year our efforts might preferably be concentrated on the important work in terminology. With that work nearing its close, I feel that further scientific activities, such as a standardization of technical practice, should be undertaken, and I heartily indorse a constructive program in this field, which the incoming President undoubtedly has in mind.

Finally, a word may be in point in reference to the financial condition of the Society, which will be set forth in detail in the annual report from the Treasurer. I wish first to strongly commend the budget system which

has been put into effect during the year by the Executive Committee and which I believe should form a permanent feature of our fiscal policy. It has permitted the administrative officers of the Society to be closely informed throughout the entire year as to its finances and to understand when any new expenditure was under consideration just how it would affect the balance sheet of income and disbursements. The principal departures in the expenditures of the Society during the year have been (1) in putting the Proceedings definitely upon a quarterly basis, (2) in providing a small amount for clerk hire to relieve the Secretary, and (3) in spending small amounts for programs and other expenses in connection with special meetings outside of Washington. All of these represent new ground which should be held. The Treasurer's report indicates a satisfactory balance at the end of the year, in consideration of the work which has been accomplished, of the assets on hand in the form of unsold back numbers of the Proceedings and of the application of the rule of striking off delinquent members from the rolls, and thereby eliminating a possible asset in the form of unpaid dues. It is apparent, however, that only very close management of its funds and the practice of certain economies which are undesirable will see the Society through on the basis of its present activities. Furthermore, unless our income is substantially increased, the development of the technical work of the Society is in danger of being seriously retarded.

I feel it unfortunate, therefore, that the proposal to restore the dues to $5 per year was lost by a very narrow margin on letter ballot. It would doubtless be inadvisable to conduct another referendum on a similar basis in the near future, but it is my suggestion that a small increase in the dues be considered immediately, in order that the Society may not run the risk of being seriously hampered in the effectiveness of its work. The Executive Committee will discuss this matter in its report.

In conclusion, I wish to express my appreciation of the support which I have received uniformly from the membership of the Society during the entire year. It has given me, in a personal way, renewed evidence of the solidarity of the foresters in America and their capacity for united effort in accomplishing things which it will be desirable for the profession to undertake. I know that my successor will have the same support.

W. B. Greeley,
President.

Report of the Secretary, Year 1915

MEETINGS

The Society held 12 meetings during the year 1915. Of these 10 were in Washington and 2 outside—the annual meeting in New York, January 1915, and the meeting at San Francisco in connection with Forestry Week at the Panama-Pacific Exposition. Included in the above are 3 executive sessions and 11 sessions open to the public. The attendance at the open meetings in Washington usually varies from thirty to forty, while that at San Francisco was 105. The attendance at the executive sessions of the last-mentioned meeting was 37, while that at the annual meeting was 31. At the other executive session, called to pass resolutions on the death of Dr. Joseph A. Holmes, scarcely more than a quorum were in attendance.

MEMBERSHIP

The membership of the Society at the conclusion of 1915 was 292; such membership consisted of 253 active, 25 associate, and 14 honorary. There have been enrolled during the year 25 active, 2 associate, and 13 honorary members; 20 of such members—7 active and 13 honorary—however, were formerly associate members, so that only 20 constitute an addition to the Society enrollment. During the year the Society has lost a total of 24 members—through death 3 active and 2 honorary; through resignation, 10 associate, and through the operation of the constitutional provision concerning delinquency in the payment of dues, 8 active and 1 associate.

These various changes are given in detail below:

New enrollments

Active members

J. B. Adams*
G. P. Ahern*
C. H. Amadon
E. S. Bruce*
B. A. Chandler
G. A. Cromie
T. W. Dwight
O. M. Evans
J. O. Hazard
Roy Headley
Ralph Hopping
C. D. Howe
J. G. Jack*
J. T. Jardine*
E. V. Jotter

Active members

L. F. Kneipp*
Herman Krauch
L. T. Larsen
C. W. McKibbin
E. P. Meinicke*
H. S. Newins
J. W. Sewell
P. T. Smith
J. H. White
Elwood Wilson

Associate members

G. P. Burns
P. P. Pitchlynn

Honorary members

C. C. Andrews*
E. A. Bowers*
S. B. Elliott*
D. R. Francis*
Arnold Hague*
F. H. Newell*
J. W. Noble*
Theodore Roosevelt*
C. S. Sargent*
V. M. Spaulding*
C. D. Walcott*
J. B. Waldo*
James Wilson*

* Formerly Associate members.

Loss by death

Active members

A. Knechtel
John Murdock, Jr.
R. L. Rogers

Honorary members

C. E. Bessey
J. A. Holmes

Loss by resignation

Associate members

H. S. Bristol
McGarvey Cline
C. E. Faxon
W. K. Hatt
A. D. Hopkins
Otto Luebkert
M. J. McVean
E. E. Schneider
A. S. Shaw
G. P. Whittlesey

Dropped for non-payment of dues

Active members

C. J. Buck
A. W. Cooper
C. H. Flory
Wilhelm Klemme
C. A. Lyford
C. D. Mell
S. D. Smith
Lage von Wernstedt

Associate members

W. H. Miller

These various changes have resulted in a gain of 14 in active membership, a loss of 31 in associate membership, a gain of 13 in honorary membership, and a loss of 4 in total membership.

CONSTITUTIONAL AND POLICY CHANGES

Four propositions have been submitted to a vote of the members during the year—three concerning constitutional changes and one concerning a change of policy. Of the former two carried, namely, the provision changing the term of office of the members and manner of election of the Executive Committee, and that concerning delinquency in dues suggested in the 1914 annual report of the Treasurer; the first by a vote of 150 for and 8 against and the second by a vote of 121 for and 31 against. The amendment to restore the dues to $5.00 was lost by a vote of 117 for and 40 against. The fourth proposition concerned the adoption of a pin emblem for the Society, and carried by a vote of 121 for and 34 against and 7 not voting. A copy of the Constitution as amended to date is attached as Exhibit II.

ADMINISTRATIVE CHANGES

The most far-reaching of these changes was in the adoption of the budget system, which grew out of the recommendation for definite allotment of funds in the 1914 annual report of the Treasurer, particularly with reference to the Editorial Board. The adoption of this system has justified itself, as will be seen from the Treasurer's report for the year.

Another forward step was the provision made for the hire of a permanent file clerk for the Secretary—permanent in the sense only that the same clerk will handle the work from year to year instead of each Secretary making his own personal arrangement, usually with his office stenographer, for assistance. A central file consequently is again an established fact; not perfect, because the alphabetical plan is still too closely adhered to, which gives the file clerk too much latitude in disposing of correspond-

ence. If this is to be continued, the various officers handling correspondence should red pencil the name or otherwise designate the subject under which a letter should be filed. The clerk, besides handling the filing, has taken off the Secretary's hands the routine work incident to the sale, distribution of, and accounting for the Proceedings. He has also been of considerable help to the Treasurer in the dispatching of follow-up bills.

The mailing-list stencils, which now number over 600, have been thoroughly overhauled and reclassified to conform to the card record adopted by the Treasurer a year ago. Furthermore, a key initial has been assigned to each class of persons comprising the list, and the appropriate initial placed on each stencil. Thus familiarity with the name of each and every individual on the list and the class to which he belongs is not necessary in order to detect a misplaced stencil. In connection with these stencils, too, the work of keeping them revised and up to date has been systematized and the chance for errors creeping in has been thus very much reduced.

A new bill form was adopted prior to sending out the 1916 statements, January 1, which combines the dues, subscription, and miscellaneous accounts all in the same form. Furthermore, it is arranged to be used with an outlook envelope and has the "no receipt" feature which is coming into such general use. The use of this bill will effect a considerable saving by eliminating the cost of one addressing and postage on the return receipt. More important still, it will greatly lighten the Treasurer's labor and give him an additional check on the work besides.

There is still room for improvement in the business methods of the Society. A closer co-ordinating and segregating of the work of the various officers and committees is desirable, by which the Secretary would be relieved of work not properly his duty to perform.

The adoption of a distinctive color of paper for carbon copies of correspondence is very decidedly needed. This will serve to identify the correspondence of the Society at a glance, and thus prevent it getting into the Service files with official correspondence to which it might by accident become attached in the messenger basket. This is one of the mysterious ways by which the correspondence of the Society becomes lost, for which the person in charge of the Society's files is often unjustly blamed.

A list of members, together with a tabulation of members by States and character of service, and the Constitution as amended to date appear in this issue. It is recommended that these be got out as separates for distribution to members. There are also other occasional needs for these data.

Respectfully submitted,

LOUIS S. MURPHY,
Acting Secretary.

Report of the Treasurer for the Year Ending December 31, 1915

Receipts

Balance from previous year				$417.75
Annual dues:				
Active members, year 1913	$3.00			
year 1914	36.00			
year 1915	746.50			
year 1916	13.50			
		$803.00		
Associate members, year 1914	$38.00			
year 1915	52.00			
year 1916	6.00			
		96.00		
			$899.00	
Proceedings:				
Subscriptions, Vol. VII (1912)	$1.00			
Vol. VIII (1913)	3.00			
Vol. IX (1914)	2.00			
Vol. X (1915)	491.00			
Vol. XI (1916)	16.00			
		$513.00		
Sale back numbers and separates		68.65		
			581.65	
Miscellaneous receipts			7.54	
Interest:				
January 1 to June 30, 1915		$5.25		
July 1 to December 31, 1915		7.34		
			12.59	
				1,500.78
Total receipts				$1,918.53

Disbursements

Account of Secretary:				
Miscellaneous printing	$92.00			
Postage (less $10, Proceedings postage)	66.24			
Clerk hire	50.50			
Stenography and typewriting	34.50			
Stationery	32.25			
Addressing	6.76			
			$282.25	
Account of Editorial Board:				
Printing 600 issue, Vol. X	$938.63			
Proof-reading	61.80			
Electrotyping	36.25			
Envelopes	32.50			
Postage	26.07			
Mailing and addressing	8.50			
		1,103.75		
Reserve, 200 copies, Vol. X		87.12		
Separates, 200 copies, Vol. X, No. 4		7.90		
			$1,198.77	
Account of Treasurer:				
Engrossing resolutions		$15.40		
Expenses California meeting		12.00		
Hire of hall for meeting, Washington, D. C.		10.00		
Express		9.09		
Refunds		5.50		

Directory, Washington Academy of Sciences....		4.95		
Telegrams		1.32		
Miscellaneous		10.00		
			68.26	
				$1,549.28
Balance on hand.....				369.25
Total disbursements.....				$1,918.53

Assets

Balance on hand.....				$369.25
Proceedings.				
Subscriptions, Vol. X (1915):				
Vaughan Jones.....	$2.00			
Georgia State College of Agriculture..	2.00			
District Forester, Vancouver, B. C....	2.00			
Director of Forestry, Canada.....	2.00			
District Inspector, Calgary, Canada..	2.00			
Director of Forestry, P. I.....	2.00			
Director of Forestry, P. I., Vol. IX...	2.00			
		$14.00		
Sales of back numbers and separates...	7.25			
Texas Agr. and Mech. College.....	11.50			
		18.75		
Texas Agr. and Mech. College (binding)		8.40		
			$41.15	
Reserve supply, Vol. X.....			87.12	
Postal deposit.....			1.74	
				$130.01
Total assets*				$499.26

* Since making up the above accounts, it has been discovered that 2 active members reclassified from associate membership were not assessed by the Secretary for dues for 1914, which amount, $6, must be considered as an asset.

Liabilities

Dues paid in advance:			
Active members.....	$13.50		
Associate members.....	6.00		
		$19.50	
Subscriptions in advance.....		16.00	
Bills payable (binding for Texas Agricultural and Mechanical College).....		8.40	
Total liabilities.....			43.90
Excess of assets over liabilities.....			$455.36

The above, as compared with last year, is a very creditable showing, notwithstanding a shrinkage in both cash and total debit balances of $48.50 and $52.90[1] respectively. Both of these are considerably less than the shrinkage in receipts, which amounted to $91.60. The receipts from dues showed a slight increase over last year, chiefly from back and current

[1] Of the $130.57 listed as assets in 1914, only $102.07 proved to be good, $28.50 having been charged off.

dues of Associate members whose status was not determined upon a year ago. The receipts from Proceedings showed a shrinkage of $260.61, chiefly in the sale of back numbers, which amounted to but $65.75, or considerably less than half what it was in 1914. There were also four less subscribers. Then, too, plate matter paid for by authors returned $50.06 to the treasury in 1914, whereas no such charges were made in 1915.

A closer supervision of expenditures, by means of a budget, made possible a saving in the cost of administration of $228. In spite of this, however, a new item of expense for clerk hire in the Secretary's office, amounting to $50.50, was taken care of and the expenses of this officer decreased at the same time by $16.35. The largest single item of saving here was in postage, which was reduced $59.11, or almost half. A $30 postage asset from last year, however, should be deducted, making the true saving $29.11. The better control of expenditures through a budget was particularly apparent in the accounts of the Editorial Board. Instead of a deficit of $224.21, as in 1914, the Board had $5 to its credit for 1915.[2]

As to assets, attention is called to the absence of any dues assets, the result of the operation of the constitutional provision concerning delinquency. Sixty-one dollars was thus charged off at the end of the year.

The item of $87.12 as an asset for Proceedings is merely the cost value of the 225 reserve sets (1,000 copies) of Volume X acquired during the year. That the nearly 1,700 other copies of back numbers constitutes in reality an asset is unquestioned, yet no attempt has ever been made to value them as such, due largely to the lack of a definite policy regarding the disposition of them. The present purchase policy needs to be backed up by an adequate sales policy, otherwise the entire general funds of the Society will be consumed in acquiring a reserve to no purpose. The reserve of back numbers should unquestionably pay its own way, and the following plan, it is believed, will provide the means.

First, as to financing the current reserve:

We should have 75 or 100 copies of each number reserved for sale only in sets, of not less than four numbers (a complete volume). We need also 25 or 50 copies for miscellaneous single-copy sale. Thus 100 or 150 copies of each issue would meet our actual needs for a reserve supply.

We are acquiring at present something over 200 reprints of each issue.

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[2] I am, however, of the opinion that our budget calculations were in error this year in considering the receipts from the sale of back numbers as an income to be used in defraying current expenses of the Proceedings. These should more properly be covered into a permanent fund in the treasury, out of which would be purchased the reserve supply of Proceedings each year.

800 copies a year. For these we pay an average of about 10 cents a copy.[3] While this number is in excess of our needs for the immediate future, there would be no economy in purchasing a less number, because we are paying a minimum charge for reprints now. We must therefore take steps to make an outlet for the surplus.

The establishment of a new class of subscribers, to be known as student subscribers, and to pay $1 a year, or one-half the regular subscription price, is therefore recommended. At this price, each subscriber would pay for his own four copies, 40 cents, and contribute 60 cents, or six copies, to the reserve. One hundred such subscribers, and it would seem entirely possible to secure at least that many from the forest students throughout the country, would thus finance a reserve supply of 600 copies—150 copies of each issue. There would be no difficulty in securing the necessary additional copies from the printer at a like or even more favorable rate. Such a class of subscriptions could be readily safeguarded from abuse by having subscriptions placed through the director of the school, and, with several copies going to one address, could be cheaply handled. Such a class of subscriptions is further justified as a means of extending our regular subscription list, since many of these student subscribers, when they graduate from school, will want to continue to receive the Proceedings. Even if there were not these pecuniary advantages, the Society would still be the gainer through the extension of its influence and of the aims and ideals which it was created to foster.

Second, as to a sale policy for back numbers:

So far as these can be made up into complete or nearly complete sets, they should be combined with the full sets of succeeding volumes and be reserved for sale *only* as complete sets.[4] There are 74 sets which might thus be reserved. There is not the remotest possible chance of the Society itself being able to provide reprints before these sets become exhausted. It is our duty, therefore, to conserve them as much as possible; not, however, by withdrawing them entirely from sale, but by raising the price.

The following scale of advance is accordingly recommended:

21 full sets, 20 per cent advance, or $9.00.
13 sets (1 number missing), 15 per cent advance, or $8.05.
14 sets (2 numbers missing), 10 per cent advance, or $7.15.
9 sets (3 numbers missing), 5 per cent advance, or $6.30.
17 sets (4 numbers missing), regular price, or $5.50.

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[3] The contract edition of 600 copies taken by subscribers and members cost 46 cents a copy to print and distribute.

[4] There are 21 full sets of the first 8 volumes, 13 additional with but 1 number missing (Vol. V, No. 1); 14 other sets with 2 numbers missing (Vol. I, No. 1); 9 others with 3 numbers missing (Vol. VIII, No. 2), and 17 sets with 4 numbers missing (Vol. VIII, No. 1).

The sets, after the first 75, decrease rapidly in the number of available numbers per set.[5] If these are to figure as an asset—and there is no reason why they should not contribute something toward their cost—their sale must be forced by offering them at a reduced price. A flat reduction in price per copy is advised against, though it is the simplest plan. Any reduction in the price of single copies is likewise advised against. Single-copy sales are relatively more expensive and time-consuming to make than lot sales and yield comparatively little return.

It is recommended that the various odd numbers be made up into sets, and that the reduction in price be made on the set and be graduated according to the number of copies comprising the set. Thus:

10 number sets, 5 per cent off regular price, or $4.75.
9 number sets, 10 per cent off regular price, or $4.05.
8 number sets, 15 per cent off regular price, or $3.40.
7 number sets, 20 per cent off regular price, or $2.80.
6 number sets, 30 per cent off regular price, or $2.10.
5 number sets, 40 per cent off regular price, or $1.50.
4 number sets, 50 per cent off regular price, or $1.00.

As to Volume IX, there are too few copies of numbers 1, 2, and 3 to make it worth while trying to make them up into sets. It is recommended that they be sold as single copies, at $1 each.

As to Volume X and Volume IX, number 4, it is recommended that 75 or 100 sets be put aside as a reserve, and that the remaining copies be sold at 50 cents a copy by the single copy and at 35 cents a copy by the set of five numbers—*i. e.*, $1.75 a set.

By the adoption of a comprehensive subscription and sales policy, framed along the lines indicated, I believe that the 1916 reserve copies could be acquired without cost, and that $300 or $400 could be returned to the general funds of the Society.

It is further recommended that an announcement of this subscription and sales policy, if approved, be published in the Proceedings, and that a sufficient number of reprints of the announcement be secured to be sent to each student in the various forest schools.

Respectfully submitted, LOUIS S. MURPHY,
Treasurer.

Accounts audited and found correct.
C. R. TILLOTSON.
E. E. CARTER.

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[5] There are 10 sets of 10 numbers each, 5 sets of nine numbers, 3 sets each of 8 and 7 numbers, 12 sets of 6 numbers, 22 sets of 4 numbers, and 151 copies of the 3 remaining numbers combined.

Report of Executive Committee, 1915

January 22, 1916.

The Executive Committee desires to submit to the Society the following report covering its activities during the year:

The New York meeting of January 11, 1915, referred the following questions to the committee for consideration and action:

> A plan for the amalgamation of the "Proceedings of the Society of American Foresters" and the "Forestry Quarterly."
>
> Amendments on membership proposed by the 1914 Executive Committee.
>
> Amendments proposed by the 1914 Committee on the Organization of the Executive Committee.
>
> Restoration of annual dues to $5.
>
> The advisability of incorporating the Society.
>
> Initiating a Society budget.
>
> Prescribing a penalty for members who become delinquent in dues.

From other sources the committee has had presented for consideration:

> The adoption of a Society pin or other insignia.
>
> Indorsement of the Federal Migratory Bird Law.
>
> The election of women to membership in the Society.

Members of the Society are familiar with the results of the ballot taken in September on four of these subjects, viz: the amendments concerning the organization of the Executive Committee, the restoration of dues to $5, prescribing a penalty for delinquents, and adopting an insignia. You will recall that all of these questions were favorably passed upon except the restoration of dues to $5, which was lost by but one vote. I shall refer later to the question of dues.

For convenience, the subjects referred to the committee, except those upon which a ballot has been secured, will be discussed in the order above given.

The Amalgamation of the "Proceedings" and "Quarterly"

This question was first brought before the Society at the New York meeting and after discussion was referred by it to this committee, with instructions to investigate the desirability of an amalgamation and to submit definite recommendations to the Society before March 11, 1915. The important features of the plan as presented to the committee were as follows:

> The combined journal to have a distinctive title, such as "American Journal of Forestry."

The journal to appear eight times per annum—*i. e.,* during the months of January, February, March, April, May, October, November, and December.

Each number to contain, as far as practicable, beside original articles, matter of the same variety as at present appears in the Quarterly.

The size of each issue to be, for the present, not less than 100 pages nor more than 150 pages, or from 800 to 1,200 pages per year.

The literary part to be managed by a Board of Editors, 14 in number, under the direction of a Chief Editor, with the advice of an Executive Committee, composed of three of the editors, of which the present Editor of the Proceedings will be chairman; the Chief Editor to be the present Chief Editor of the Forest Quarterly, who will appoint eleven of the Board of Editors; the Society to appoint three editors, who will constitute the Executive Committee.

The Editorial Executive Committee to pass upon all original articles that are to appear.

The subscription price to approximate $3 per annum, and the journal to be accepted as the official organ of this Society and the Canadian Society of Forest Engineers.

Had the plan as submitted been approved by the committee, it might have been practicable to have presented a report within two months, but the entire question seemed to the committee so important that it desired to secure more detailed information concerning its various features and to give it thorough consideration before submitting a recommendation to the Society, which accounts for the committee's failure to comply with the wishes of the New York meeting.

The committee is in agreement on the desirability of the amalgamation. It believes that a combination of the journals, to which practically all foresters in the country subscribe or have access, would be beneficial and economical. This opinion is shared by the Missoula Section of the Society, to whom the question was referred by Mr. Silcox, and by those members of the Society who were present at the San Francisco meeting at which the following resolution was passed:

> "That the Society of American Foresters will welcome the plan for combining the 'Forestry Quarterly' with the 'Proceedings of the Society of American Foresters' under an arrangement entirely satisfactory to Dr. Fernow and in keeping with his desires and policies for the maintenance of a technical journal of forestry, and would appreciate suggestions from Dr. Fernow to this end."

It was not clear to the committee, however, wherein a change in the present constitutional arrangement for handling the Proceedings was

necessary if the combination were effected, unless the plan proposed were insisted upon by Dr. Fernow on behalf of the Quarterly. You will recall that the Constitution on this point now reads:

> ARTICLE V, SEC. 5. "The Editorial Board shall be appointed by the President and shall consist of nine (9) members. Within this Board there shall be appointed an executive committee, one member of which shall be designated by the President as 'Editor-in-Chief.' The Board shall decide on the regular policy of the publication. The Executive Committee shall consider papers read before the Society, or otherwise submitted to it, shall approve or reject them for publication, and shall transact the business necessary to that end."

It soon became evident from correspondence with Dr. Fernow that he attached no great significance to the number of men on the Editorial Board or other details of management outlined in the plan, except that the personnel outlined was his conception of the personnel needed for the combined journal. He did feel, however, that were such a combination effected his interest in the Quarterly, in the publication of which he has sustained a loss, should entitle him to a tenure of office as Editor-in-Chief of the combined journals. Wholly aside from this purely business aspect of the matter, the committee has looked upon the appointment of Dr. Fernow as prospective Editor-in-Chief as a natural sequence to the action, and in its opinion the material interest he has in the Quarterly should serve to make that appointment an indefinite one. In this way the Society not alone can recognize his equities in the Quarterly, but can pay fitting tribute to his leadership in the forest literature of the country.

Since the practicability of the combination from a financial standpoint is important, I desire to discuss that feature briefly. By a review of the Society and Quarterly records, it was found that the prospective issue of the combined journal would probably be:

Members of the Society of American Foresters (including Honorary members)	336
Subscribers	583
Complimentary copies	5
Copies to editors	20
Exchange	25
Reserve	231
	1,200

The reserve (231) is based upon eight issues per year, of from 100 to 150 pages per issue, or a total of from 800 to 1,200 pages per year.

The prospective revenue, based (1) on a retention of the present annual

dues and $3 subscription price, or (2) on an increase in dues of Active members from $3 to $4, and of Associate members from $2 to $3, would be as follows:

(1) At $2 each from members and $3 each from subscribers.

	Active.	Associate.	Total.	Amount.
Members of Society	300	23	323	$646
Subscribers	...	..	583	1,749
	300	23	906	$2,395
Sale of reserve copies (assuming full return on 33⅓% of them @ $3 per volume)				231
Total				$2,626

(2) At $3 each from members and subscribers (assuming an increase in dues of Active members from $3 to $4 per annum and of Associate members from $2 to $3).

	Active.	Associate.	Total.	Amount.
Members of Society	300	23	323	$969
Subscribers	...	..	583	1,749
	300	23	906	$2,718
Sale of reserve copies (assuming full return on 33⅓% of them @ $3 per volume)				231
Total				$2,949

Active members now pay $3 per annum dues, of which $2 goes to the Proceedings fund; Associate members pay $2 per annum, which represents both dues and subscription price to the Proceedings, and Honorary members receive the Proceedings, but pay no dues. The Society is dependent for its general expenses on a levy of $1 against the dues of each Active member.

In calculating the prospective cost of the combined publications, an issue of 1,200 copies, 125 pages per copy, and eight issues per year has been assumed. From experience in publishing the Proceedings, the average cost per issue of 800 copies of 125 pages of similar quality to the present Proceedings is $265. The excess cost for additional copies, on the basis of the present publisher's contract, would raise the publishing cost per issue to $308.75, to which must be added approximately 8 per cent for proof-reading, postage, and other incidentals, making the cost for publication and distribution $333.45 per issue, and for eight issues $2,667.50. To this should be added $300, a conservative sum needed for stenographic assistance. The aggregate cost thus becomes $2,967.60 per year.

The estimated revenue ($2,626 without increase in dues, and $2,949 with an increase of $1 in dues) is conservative, and the aggregate cost of publication ($2,967.60) is high. A party thoroughly familiar with magazine publishing rates has informed me that he believed an issue of 1,350 copies in quality equal to the present Proceedings could be contracted for, on the basis of eight issues a year and 125 pages per issue, at approximately $2,700.

From the data obtained by the committee, it believes that there is a fighting chance of publishing the combined journals without increase in dues, but strongly recommends against it. The Society should at least provide the revenue estimated under the second plan—*i. e.,* increasing dues $1—to insure a reasonably sound business management for the publication. It should be borne in mind that subscriptions to the "Proceedings" and "Quarterly" are now $2 each, and that $4 dues would simply mean furnishing $3 per member (excluding Honorary members) or subscriber for publication, in contrast to the $4 now available to the separate journals. It would require $5 dues and $4 subscription to place the combined publication on the same financial footing as the separate publications, on which basis the Society would still be dependent upon a levy of $1 against dues from Active members to meet its running expenses, unless the Editorial Board could turn over a surplus for this purpose. The estimate given indicates, however, that with an increase of $2 in dues an allotment of $4 per member for the publication would not be necessary, thus leaving a larger margin than $1 per member for running expenses.

To summarize the views of the committee on the amalgamation of the journals.

It recommends:

(1) That an amalgamation of the "Proceedings" and the "Forestry Quarterly" be made, whether or not an increase in dues is necessary to accomplish it.

(2) That the plan of control of the combined publications conform to that given for the Proceedings in the present Constitution of the Society (Article V, Sec. 5), subject to amendment as to the number of members on the Editorial Board, upon the recommendation of the Board after organization.

(3) That the details of publication and policy of the journal be left with the Editorial Board.

(4) That the dues for Active and Associate members be increased at least $1, in order to assure the journal sufficient financial support and the Editorial Board adequate assistance in producing a publication of high standard.

(5) That the consolidation be made effective January 1, 1917.

The committee further recommends to the President for 1916 and to succeeding Presidents the appointment of Dr. Fernow as Editor-in-Chief of the combined journals, provided the interests of the Society are not impaired thereby.

The committee indorses the proposals that the name of the journal be the "American Journal of Forestry"; that it be issued eight times per year, preferably during the months of January, February, March, April, May, October, November, and December, and that an attempt be made to have the Canadian Society of Forest Engineers accept the publication as its official organ.

Amendments on Membership Proposed by 1914 Executive Committee

The amendments proposed by the 1914 committee concerning membership had two objects in mind: (1) extension of the Active membership, and (2) broadening the scope and activities of local Sections. To effect the former, a Junior membership was suggested under a dual membership plan. To effect the latter, the committee proposed to reduce the number of Active members required to establish a local Section from ten to five. It further proposed that each Section elect Associate members. Such members would not, however, be considered Associate members in the Society within the meaning of the present Constitution.

The question of making the qualifications for membership more clear-cut and broadening the scope of membership has been under consideration by the Admissions Committee for some time. The need for a decision along these lines became clearly apparent from comments received by that committee in response to its lists of applications for membership of December 10, 1914, and June 15, 1915, sent to the members for comment. Since the presentation of these names by the Admissions Committee served to bring out a general discussion of the entire question throughout the Society, it was felt inadvisable by the Executive Committee to independently consider the question and work at cross purposes with the Admissions Committee. It was consequently decided to formally refer it to that committee with the request that, after reaching a conclusion from the comments received from the members, it submit its recommendations to the Executive Committee for consideration.

Since the need for action in broadening the scope and activities of local Sections depends upon the Society's attitude toward the plan of dual membership, action on the 1914 committee's recommendation relating to local Sections has been deferred, in order that the two interrelated questions may be considered by the Executive Committee and submitted to the members for ballot at the same time.

The committee indorses the general plan of dual membership, believing this to be the most effective way of extending the influence and accomplishments of the Society as a whole. Dual membership was also indorsed by the San Francisco meeting in October, which passed the following resolution:

> "That the qualifications for membership remain as at present, with more effective machinery, to be determined by the Executive Committee, for determining achievement or attainment in professional work; that a limited number of persons of distinct achievement be selected each year by the Society at large as Fellows of the Society."

Time has not permitted action by the committee on the membership plan recently formulated by the Admissions Committee and contained in the annual report of that committee. In the absence of action by the committee as a whole, my recommendation is that the plan now suggested by the Admissions Committee be referred to the 1916 Executive Committee for its consideration and submission with its recommendation to the Society for ballot. My further recommendation is that there be referred to the 1916 Executive Committee also the recommendations of the 1914 Executive Committee concerning broadening the scope and activities of local Sections, in order that the two questions may be harmonized and presented to the Society for ballot at the same time.

Incorporation of the Society

The committee feels that the incorporation of the Society is not at present urgent, but that the appropriate time at which to consider it is when the membership standards have been more definitely fixed, as contemplated by the recommendations of the Admissions Committee, and after the Society is placed upon a stronger financial basis.

Society Budget

In response to the suggestion of the New York meeting, a budget for 1915 was prepared by the Treasurer and approved by the Executive Committee. The suggestion of that meeting that adequate clerical help be furnished to the Secretary, so as to relieve him of routine clerical work connected with his official duties, was carried out as far as funds permitted. It was possible, however, to furnish only $100 for this purpose, which has been consumed largely in paying a clerk to systematize the Society files and take over a small quantity of the routine work. It was considered necessary by the Executive Committee, in acting upon the estimates submitted by the Editorial Board and Secretary, to keep the

expenditures of the Society within its current income, under the general plan of making the "Proceedings" self-supporting and confining the general expenses of the Society within the remaining amount secured from dues. In order to do so, the estimate of the Editorial Board was cut $193, that of the Secretary $40, and the Treasurer allotted for miscellaneous expenses an amount less by $85 than was necessarily expended the previous year. This action was taken reluctantly, since the additional expenditures estimated for were highly desirable in improving the "Proceedings" and in placing the management of the Society's affairs on a more efficient basis.

The budget estimate of receipts for 1915 was $1,538, and expenditures to this amount were authorized. An additional expenditure of $71 to cover the cost of surplus copies of the "Proceedings" was authorized. It is gratifying to report that the expenditures for the year have exceeded the estimated receipts by a very small margin ($11.28); in reality not a deficit, since the sale value of the reserve copies of the "Proceedings" published far exceeds this amount. This showing has been possible only through untiring efforts on the part of the Treasurer, Secretary, and Editorial Board in seeing that the utmost economy was practiced. These officers are deserving of the commendation of the Society for this accomplishment.

The budget plan has been so effective as to make its retention indispensable, and it is recommended that it be continued in force indefinitely.

Federal Migratory Bird Law

On September 4, 1915, the Counsel for the American Game Protective & Propagation Association requested the support of the Society to the Federal Migratory Bird Law (Act of March 4, 1913, 37 Stat., 847). Since the request was received directly before the San Francisco meeting, it was referred by the Secretary to the chairman of that meeting for its consideration and later reference to the Executive Committee. The San Francisco meeting, after a discussion of the subject, passed the following resolution:

> "*Resolved.* That the Society of American Foresters considers the Federal Migratory Bird Law desirable legislation and indorses the effort of the American Game Protective & Propagation Association to maintain it."

The Association's request and the resolution of the San Francisco meeting were referred to the Executive Committee, which, with the exception of Professor Roth, favors action by the Society indorsing this law and its maintenance. If I understand Professor Roth's position correctly,

his objection to such action is not based upon disapproval of the Federal Migratory Bird Law, but rather upon the belief that the Society should give expression to its position on forestry matters only. While I cannot speak for the remaining members of the committee on the general question of the extent to which the Society should voice its approval or disapproval of questions not strictly of a forestry character, all members except Dr. Roth favor the Society going on record as indorsing the Federal Migratory Bird Law. My recommendation, then, is that the matter be placed before the Society for ballot, since the Society should be committed to such action only as it is supported by the controlling number of individual members.

Election of Women to Membership

This question should be considered in connection with any amendments proposed on membership standards and broadening the scope and activities of local Sections. In a ballot taken by the 1915 Admissions Committee four members of that committee favored the admission of women to membership on the same basis as men, and four members on the basis of their admission as Associate members. The consensus of opinion of the Executive Committee is that if women can qualify for membership under the qualifications required for any class of membership, they should be admitted to the membership for which they qualify on the same basis as men. It is recommended that this question also be referred to the succeeding Executive Committee for consideration in connection with the general question of membership standards.

Annual Dues

I wish to refer now to the question of annual dues. When the restoration of annual dues to $5 was placed before members for ballot in September, it was lost by but one vote. Under the circumstances the committee has no hesitancy, particularly since at that time no conclusion had been reached on the advisability of the amalgamation of the "Proceedings" and the "Forestry Quarterly," in again bringing up the subject and strongly urging an increase in dues. It is clearly apparent from the attitude displayed at the New York and San Francisco meetings that the members feel a need for greater aggressiveness on the part of the Society in order that its existence and influence may be more widely felt. The spirit is willing, but the purse is lean. The millstone of low dues must be removed before an advance can be made. It is admirable to have ambition, but unless one has also the tools for accomplishment ambition is merely a good subject for conversation. The economies necessary during

the past year in order to strike a balance in the budget should be convincing evidence to members of the Society that to discuss employing a permanent Secretary, effecting a consolidation of the "Proceedings" and the "Quarterly," and otherwise assuming an aggressive attitude is wholly inconsistent with the present annual dues. Three dollars dues means that the Society must stand still and depend for a showing upon the accomplishments under difficulties of its officers and individual members. While they may be made effective under the circumstances, they are not to be compared with results which will follow a better financial standing and a concerted move by the Society as a whole toward higher and bigger things. There are many ways in which we can expand. Among other suggestions received by the committee for consideration and action by the Society are a compilation and distribution of data on forest investigations throughout the country; summarizing or abstracting and printing reports in the Forest Service and in the States not considered appropriate for publication in bulletin or report form, due to a limited field of readers, but of considerable interest to the profession; making the Society an authoritative source of information on the character and uses of Pan American woods, and the preparation of symposia on State forest activities, standards in effect at forest schools, and on other topics of professional interest. The members of the Society must realize that with a limited number of foresters in the country progress along such lines will be very slow on $3 dues. Possibly in submitting the question for ballot the committee did not make its financial statement sufficiently strong. With but need for one ballot to effect an increase in dues, the need for which is clearly apparent, the committee without hesitation again presents the matter for your consideration with an urgent recommendation that the dues be restored to $5. If this action is taken, it can be safely said that the Society will pass into a new era of accomplishment and influence.

In order to harmonize the committee's recommendations on dues, therefore, it is recommended that, if supported by this meeting, the restoration of dues to $5 per annum be again placed before the Society for ballot, and that, failing the support of this meeting, its recommendation of an increase in dues of $1 stand as a feature to the amalgamation of the "Proceedings" and the "Quarterly."

Local Sections

The committee wishes to report its approval to the establishment of a Section, known as the Southwestern Section of the Society, at Albuquerque, N. Mex., whose membership will comprise those resident in Arizona and New Mexico, and the approval of the establishment of a

Section at Denver, to be known as the Denver Section of the Society, whose membership is to comprise members in Colorado, Wyoming, South Dakota, Kansas, and Nebraska. The Society now has five local Sections—*i. e.,* at Portland, Ore.; Missoula, Mont.; St. Paul, Minn.; Albuquerque, N. Mex., and Denver, Colo. It is believed that, with the spirit manifested at the New York and San Francisco meetings and the intense interest taken by the members on the question of membership standards and broadening the scope of the Society's activities, we can expect more applications for the establishment of local Sections.

Commendations

The Committee wishes to commend the work being done by the Committee on the Revision of Terminology, the symposia secured on topics of professional interest, and the constructive attitude taken by the members in its local and annual meetings. As previously stated, however, it believes that accomplishments along progressive lines will necessarily be restricted if the finances of the Society are not placed on a more satisfactory basis.

R. Y. Stuart,
Chairman Executive Committee.

Report of the Editorial Board, 1915

The last issue completed ten volumes of the Proceedings, covering the Society's activities from May, 1905, to December, 1915. During these ten years the Society unfolded from the pupa stage to maturity, and of this development the Proceedings has been a true reflection. At the beginning an irregular publication, appearing only once a year, it later increased the number of its issues to two, then to three, and in January, 1914, became a quarterly. As a quarterly, it is now firmly on its feet. Instead of a dearth of original articles available for publication, the question in the future promises to lie in properly selecting articles from among the number submitted.

With Volume IX was inaugurated a department of reviews. The aim of this department is to consider only the most important publications on forestry and to make the reviews both thorough and impartial.

In the third issue of Volume X was started a department of "Society Affairs," in which are recorded the activities of the Society and its Sections, as well as other news of interest to the members.

There is now in contemplation a department of scientific notes and comments, to record, briefly, important developments in the field of forestry and allied sciences, and to discuss these editorially.

On several occasions attention has been called to the somewhat misleading title of our publication. The Proceedings is not the proceedings of the Society in the sense that it records in full all of the papers delivered at meetings and the discussions in connection with them; rather it is the official organ of the Society, in which are printed papers selected from among those delivered at the meetings, and also articles contributed by both members and non-members. In the early days of the Society many of the set talks at meetings were given without a prepared manuscript, and it was often impossible later to obtain typewritten copies of some of the papers for inclusion in the Proceedings. At that time, too, most of the members of the Society were in the Forest Service at Washington and attended each meeting, so that there seemed no need for stenographic record of the discussions. In consequence, the custom became fixed of printing only the more important papers, without much, if any, of the discussion, thus making the Proceedings what the situation then existing seemed to call for—a medium for the discussion of various phases of forestry in a freer and more informal way than could be done in government publications. As the Society grew and the membership became widely scattered, the need developed for keeping each Section informed as to what the other Sections were doing and of what progress was being made in the profession at large. To meet this, the departments previously mentioned were established in the publication, and others were projected. It is the opinion of the Editorial Board that the interests of the profession will be better served by a journal of this kind than by proceedings in the literal sense of the term. In view of this, the Board is inclined to recommend that the present title of the publication be changed to "The Journal of the Society of American Foresters."

It may be proper at this time to state in some detail the principles by which the Board is guided in its conduct of the publication. The Board is most emphatic in its conviction that only the fullest freedom of expression can lead to the discovery of truth. It therefore consistently refrains from any attempt to influence the opinions expressed or the viewpoint taken in papers submitted for publication in the Proceedings. It aims, in fact, to obtain papers from men of the most divergent views, in order to shed as much light as possible on any particular subject under discussion. If some contributors, officially connected with the Forest Service, have, on rare occasions, been disappointed by the failure of their papers to appear in the Proceedings, or by the appearance of the papers

with some modifications, the reason must be sought in the regulations of the Department of Agriculture governing publication of articles by its members in outside journals. Papers submitted by members of the Forest Service for publication in the Proceedings must receive the approval of the branch concerned, and then of the Secretary of Agriculture. The only editorial prerogatives exercised by the Board are those necessary to insure that all discussion will be kept on a high professional plane and free from personalities. In a few instances the Board has suggested that papers submitted for publication be reduced in size as a necessary measure of economy in printing. The Editorial Board reserves the privilege of returning to the author for further revision manuscripts and drawings which are not in proper form for the printer. Wherever the author so desires, the editors will have the necessary changes made in Washington, charging the author with the cost of the work. Illustrations are included only when absolutely necessary and must be confined largely to text figures or diagrams of simple character. If it seems necessary to include other illustrations, the editors may, at their discretion, call upon the author to defray the cost.

Papers that have appeared elsewhere are not accepted for publication, nor is simultaneous publication in another journal permitted. A scientific periodical, the aim of which is primarily to present new ideas and discoveries, cannot afford to reprint articles, no matter how good, simply for the sake of bringing the ideas they contain before a larger circle of readers. Moreover, the space in the publication is necessarily limited, and it would not do to crowd out new articles by the inclusion of material which has previously appeared somewhere else.

In order to make the Proceedings representative of the profession as a whole, the Board encourages the submission of papers by members outside of the Forest Service, and gives preference to such articles whenever in importance and quality they are equal to those submitted by government men. Since, necessarily, not all of the topics of interest to the profession are discussed at the meetings of the Society in Washington or of the Sections in other cities, the Editorial Board has on several occasions taken the initiative in arranging symposiums on certain subjects which were particularly timely and interesting. In doing this it has often worked in co-operation with the Program Committee.

RAPHAEL ZON,
Editor-in-Chief.

Report of the Committee on Admissions

January 15, 1916.

During the year the committee practically completed action on the candidates for membership published in the lists of December 10, 1914, and June 15, 1915. These lists contained 102 names proposed for Active, 19 for Associate, and 1 for Honorary membership. The committee has elected 32 to Active, 18 to Associate, and 7 to Honorary membership. The action on 8 names has been adverse. The remainder of the names still require the vote of one member of the committee. These lists, the largest which have ever been considered for membership in the Society, are the result of a systematic canvass of foresters in the United States and Canada eligible for membership, started by preceding membership committees.

A much more careful consideration of the proper basis for membership in the Society has resulted in part from the modification of the Constitution, which makes the Committee on Admissions responsible for elections, the submission of large numbers of names, and finally the constructive and helpful comments received from many members and groups of members in the Society who have been interested in seeing that proper standards of membership were secured.

The feeling that a proper basis for membership had not been reached is responsible, first, for a considerable delay in final action on the list of December 10, 1914, and, second, for the publication in the list of June 15, 1915, of specifications which attempted to interpret the consensus of opinion among the members of the Society as a whole. The basic and most important principle in these specifications is the emphasis upon achievement in forestry as the essential qualification for Active membership. Training in forest schools or elsewhere, as well as practical experience, is given proper recognition, but the controlling emphasis is placed upon achievement. The committee has experienced serious difficulty in obtaining from members who have proposed candidates proper statements of their qualifications, and this will undoubtedly result in suspended action on many of the names published in the two lists above mentioned.

The committee feels very strongly, however, that the final solution of the membership question has not yet been reached. The present membership classes of the Society include:

(1) Active members—the governing body of the Society, elected from professional foresters primarily on the basis of achievement in the profession;

(2) Associate members—persons of achievement in lines of work closely related to forestry who have shown substantial interest in American forestry; and

(3) Honorary members—chosen from those who have rendered distinguished service to forestry in America or elsewhere and from professional foresters of achievement whose field of work is outside of that specified for Active members.

The largest class of men who might desire admittance to the Society and are not now eligible are those who have adopted forestry as their profession and who have not yet had the opportunity for achievement warranting election to active membership.

It has been suggested that this class of men be admitted by greatly reducing the requirements for Active membership, and that a new class of members, to be called Fellows, be created. A majority of the committee does not favor the idea. It believes that the great majority of foresters in the United States who might be eligible to such a class would much prefer to retain the comparatively unpretentious title of Active members and the more active and direct connection which the name implies with the current activities of the Society. The Fellows class may be more suitable in the future, when a large percentage of the profession has reached advanced years, with records of distinguished service. The occasional forester in the United States who might be considered for especial honors today can, under present constitutional provisions, be elected to Honorary membership.

The committee strongly believes, however, that it should be possible to take into the Society many of the large groups of men who are actively engaged in the work of the profession and who are not yet, or who may never become, qualified for Active membership, but who desire to be connected with a professional organization. We believe that a new membership class should be created and called "Junior" members. This name is not altogther satisfactory and might not be very acceptable to men of long connection with the profession not eligible to Active membership, but a more satisfactory one has not yet been suggested. The requirements as to achievement should not be severe. Graduation from a forest school of recognized standing, with possibly one year's practical experience in forest work, or an equivalent period of reasonably successful practical experience—roughly, four or five years—should be sufficient. Candidates should be indorsed by at least three members of the Society, two of whom should be Active members.

The provision of the Constitution which requires six affirmative votes out of seven of the Committee on Admissions for election to Active

membership should be liberalized by requiring only five for election to Junior membership.

The committee believes that if a new class of members is added the requirements for election to Active membership should be slightly increased; for instance, by five instead of three years' practical experience for men with forest-school training and nine years for those without, indorsement by at least five Active members before consideration by the Committee on Admissions, and a somewhat greater emphasis on and closer scrutiny of achievement.

While the committee believes that there might be little danger in allowing Junior members to vote, to hold the various offices, and to serve on the regular committees, it may be advisable at the present time to restrict these privileges, since it will be very much easier to extend than to restrict them in the future. For the present it would probably be best to allow representation on the Executive Committee by one Junior member and to allow a minority representation on special advisory committees appointed from time to time by the President for special purposes as may be deemed best in each case. It will probably also be possible to allow Junior members to submit advisory votes on many questions of importance that are brought before the Society, in order to keep them in full touch with the activities of the Society and its aims and to secure the benefit of their judgment. Junior members should obviously receive the Proceedings and should be required to pay dues sufficiently large to cover the cost. This for Associate members is now estimated at $2 per annum.

The constitutional provision regarding the qualifications of Junior members should be substantially as follows:

> "Junior members shall be professional foresters, whose field of work lies within the United States or its possessions or within the Dominion of Canada."

The following interpretation of this provision should be the basis for election:

I. *Professional Foresters*

To be a professional forester a candidate

1. (*a*) Must have acquired technical training in forestry
   - (1) At a forest school of recognized standing,
   - (2) In practical work, or
   - (3) In study outside of forest schools; or

   (*b*) He must have had an equivalent training in some closely related work which is contributing directly to the advancement of forestry, together with a broad knowledge of forestry and its fundamental principles.

2. His work must lie within or contribute directly to the development of one or more of the major divisions of forestry.
   (*a*) Forest management.
   (*b*) Forest protection.
   (*c*) Forest administration.
   (*d*) Forest utilization.
3. He must have definitely shown an active interest in the work of the profession and a desire to further its objects.

II. *Field of Work*

This provision of the Constitution on this point needs no interpretation.

III. *Practical Experience*

As an indication of permanent interest in the profession and to afford a better opportunity for judging whether the candidate is a professional forester:

1. The candidate should be a graduate of a forest school of recognized standing (with one year's practical experience), or
2. Have had practical experience in forestry of four years in lieu of training in a forest school.
3. If the period spent in a forest school or in study outside of forest schools has not equaled four years, the difference may be required in practical experience.

IV. *Achievement*

No special showing in achievement will be required. Graduation from a forest school of recognized standing (plus one year of reasonably satisfactory work) will be accepted as satisfactory evidence in this respect. In case of foresters not graduates of forest schools, a showing of reasonably satisfactory work in the profession is expected.

V. *Indorsement*

Indorsement by at least three members of the Society, two of whom must be Active members, will be required. If a local Section has been formed, the vote of the members will be required.

Other revisions of the Constitution will be necessary to cover the privileges of members, their dues, etc.

The Constitution now requires publication of the names of candidates for a period of two months. The committee believes that all essential requirements will be met by publication for a shorter period, such, for instance, as one month. This should make possible somewhat quicker action on the names of candidates, which is now much too long. The provision of the Constitution (Article III, Section 5) which provides for brief statements as a basis for election to membership should be modified to provide for full statements. The candidates for membership under present conditions are not personally known in many instances to mem-

bers of the Committee on Admissions, and full statements are needed for intelligent action.

The committee has, so far as possible, attempted to secure the indorsement of candidates by local Sections of the Society where formed, and in fact has in most cases regarded such indorsement as a prerequisite of election. A preliminary vote on candidates is a logical function of the Section and is of the greatest assistance to the committee in supplementing the written record of qualifications. Such a vote should be required uniformly hereafter. Final action in the election of new members should rest, however, with a central committee, in order to maintain uniform standards for the Society.

A majority of the members of the committee favor the election of women to membership on the same basis as men.

As a result of suggestions received and experience in the handling of large numbers of candidates, the committee believes that its action would be materially assisted by the printing of a brief circular dealing with election to membership. This would greatly reduce the amount of correspondence which now falls upon the chairman of the committee and should result in much more satisfactory statements regarding candidates, and hence in adherence to more consistent standards by the committee. A draft of such a circular follows. Modification will obviously be necessary if the recommendations of the committee regarding a new membership class are accepted.

EARLE H. CLAPP,
Chairman.

MEMBERSHIP IN THE SOCIETY OF AMERICAN FORESTERS

The purpose of this circular is to make available information concerning the requirements and procedure in the election of members to the Society of American Foresters. Three classes of members are provided for in the Constitution:

1. Active members, who must be professional foresters of achievement in the United States or Canada;

2. Associate members, persons of achievement in closely related lines of work who have shown substantial interest in American forestry, and

3. Honorary members, who have rendered distinguished service to forestry or who are foresters of achievement not eligible as Active members.

The procedure in election is, briefly, as follows:

1. Proposal of the candidate, properly indorsed, and with a full biographical statement to the Committee on Admissions.
2. Publication periodically of the names of candidates by the Committee on Admissions for a period of two months, to permit comment and recommendations.
3. Vote on the candidate by the Committee on Admissions. Six affirmative votes are necessary for election.
4. Notification of the election or rejection by the Secretary of the Society.
5. Acceptance of membership by the candidate.

The provision for election to membership is as follows:

> "ARTICLE III, SECTION 5. Any Active member may propose names of candidates for Active, Associate, or Honorary membership. Such names shall be submitted in writing to the Committee on Admissions, accompanied by a *brief*[1] biographical sketch giving [*fully!*][1] the qualifications of the candidate for admission to the Society. The names of all candidates proposed shall be referred to all Active members of the Society for comment or protest at least two months before final action is taken by the Committee on Admissions. The Committee on Admissions will then decide what candidates shall be elected, six affirmative votes being necessary to admit any candidate to membership in the Society."

The names of candidates received are held until a sufficient number have been submitted to warrant publication. This may involve more or less delay. The purpose of publication prior to final consideration by the committee is to serve (1) as a general notification to the membership of the Society that the candidates whose names are included in the lists are being considered for membership, and (2) to secure from members of the Society all available information regarding the qualifications of candidates. This enables the committee to take final action with the full knowledge of all essential facts. All Active members are urged to furnish the committee with the facts regarding any candidate which are likely to be of value in reaching a decision and to submit recommendations for or protests against election. For convenience in voting and filing, statements on different men should be made on separate sheets.

ACTIVE MEMBERS

Article III, Section 2, provides that

> "Active members shall be professional foresters of achievement, whose field of work lies within the United States or its possessions or within the Dominion of Canada."

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[1] **Article III, Sec. 5, should be modified by the omission of "brief" and the insertion of "fully."**

The following interpretation of this provision has been agreed upon as a basis for election:

I. *Professional Foresters*

To be a professional forester a candidate

1. (*a*) Must have acquired technical training in forestry
   (1) At a forest school of recognized standing,
   (2) In practical work, or
   (3) In study outside of forest schools; or
   (*b*) He must have had an equivalent training in some closely related work which is contributing directly to the advancement of forestry, together with a broad knowledge of forestry and its fundamental principles.
2. His work must lie within or contribute directly to the development of one or more of the major divisions of forestry.
   (*a*) Forest management.
   (*b*) Forest protection.
   (*c*) Forest administration.
   (*d*) Forest utilization.
3. He must intend to make forestry his life work within the above interpretations.
4. He must have definitely shown an active interest in the work of the profession and a desire to further its objects.

II. *Field of Work*

This provision of the Constitution on this point needs no interpretation.

III. *Practical Experience*

As an indication of permanent interest in the profession and to afford a better opportunity for judging achievement:

1. A minimum of three years' practical experience in forestry will be required—that is, outside of forest schools or the equivalent as indicated under 2 and 3.
2. A period of four years of practical experience in forestry may be required in lieu of training in a forest school.
3. If the period spent in a forest school or in study outside of forest schools has not equaled four years, the difference may be required in practical experience.

IV. *Achievement*

Achievement in forestry will be the essential determining qualification. The showing must be clear of definite and noteworthy achievement which contributes directly to the development of one or more of the four phases of forestry indicated under I, 2. The showing must be of initiative and original thought. It must clearly be above a mere routine and satisfactory performance of customary and directed duties.

It may consist of:

1. Advancement to a position of responsibility and a showing of noteworthy efficiency or service in
   (*a*) A forest school of recognized standing.
   (*b*) Federal service.
   (*c*) State service.
   (*d*) Private service.
2. Some definite and important contribution to the advancement of forestry.
3. The authorship of a noteworthy publication on some phase of forestry.
4. The development of a reasonably good practice in private forestry and its maintenance over a period of three years.

V. *Indorsement*

The name of each candidate should be indorsed by five or more Active members of the Society. If a local Section has been formed, the vote of its members will be required.

In submitting a statement of the qualifications of the candidate to the chairman of the Committee on Admissions, at least the following points should be covered:

1. Name of candidate in full.
2. Address.
3. Age.
4. Evidence that the candidate is a professional forester.
   a. Training in forestry, giving the forest school and degrees obtained, or the character and extent of the work which has resulted in an equivalent training. If the candidate is recommended because of an equivalent training in closely related work, the showing must cover his training and his knowledge of forestry and its fundamental principles.
   b. Evidence that the work of the candidate lies within or contributes directly to the development of one or more of the major divisions of forestry—forest management, forest protection, forest administration, or forest utilization.
   c. The life work of the candidate.
   d. Evidence of an active interest in the work of the profession and a desire to further its objects.
5. Field of work.
6. Practical experience. The length of practical experience of various kinds in forestry, with dates.
7. Achievement. This is the most important phase of the entire statement and should be full and specific. To be convincing, it should cover the various assignments of the candidate, the work he has undertaken, an analysis of the results, and an interpretation of their bearing upon and importance in the

development of forestry. The various positions which he has held in private, State, or Federal service should be indicated and the importance of these positions made clear. Publications should at least be listed, with a brief statement of their character and importance.

8. Indorsement by at least five Active members. If a local Section has been formed, the vote of its members should be submitted.

The Committee on Admissions is compelled to take the position that the burden of proof of showing that the candidate is qualified for admission to the Society rests upon the members who propose his name.

ASSOCIATE MEMBERS

Article III, Section 3, of the Constitution provides:

> "Associate members shall be persons of achievement in lines of work closely related to forestry who have shown substantial interest in American forestry. They may attend all meetings of the Society and take part in its discussions, but shall not be entitled to vote."

To qualify for Associate membership, a showing of achievement should be made in lines of work closely related to forestry, such, for instance, as forest pathology, forest entomology, forest botany, grazing in connection with the administration of forests, etc., equivalent to that in forestry required for Active membership. Professional foresters are not eligible to Associate membership. They should be elected to Active membership or not at all. The Associate membership grade should be retained for those men who have shown substantial interest in the cause of forestry, whose work is more or less connected with the development of forestry, and whose achievement is such that the Society feels justified in honoring them with election.

At least the following points should be covered in the statement of qualifications submitted to the chairman of the Committee on Admissions:

1. Name of the candidate in full.
2. Address.
3. Evidence of achievement in lines of work closely related to forestry, what the work has been, in what way it is related to the development of forestry, statement and analysis of accomplishments and an interpretation of their significance, positions held, and an indication of their importance. Important publications listed, with a brief statement of their character and importance.
4. Evidence of interest in American forestry.
5. Indorsement by at least three Active members of the Society or by a Section.

HONORARY MEMBERSHIP

Article III, Section 4, provides that:

> "Honorary members shall be chosen from those who have rendered distinguished service to forestry, either in America or abroad, and from professional foresters of achievement, whose field of work lies outside of the United States and its possessions and the Dominion of Canada. They may attend all meetings of the Society and take part in its discussions, but shall not be entitled to vote."

This class of membership should be reserved for those whose services to the cause of forestry are of such a character as to warrant the highest recognition in the power of the Society to give. The foresters selected for Honorary membership from abroad should be leaders in the profession in their own countries.

A statement covering the character of the service rendered and an appreciation of their value should be submitted with the name of each candidate.

Report of Committee on Meetings

January 22, 1916.

The committee began its labors immediately after appointment, early in the year 1915, in order to develop the general outline of the programs to be presented during the present season. The purpose of this early action was to give ample time to select the more important subjects for consideration and to find the men who are best prepared to present these subjects to the Society, and, further, to give these men time so that they would not be rushed in the preparation of their papers.

The program which was printed and distributed in the early part of October is the result of these labors. It provides for monthly meetings in Washington from October to May and for the annual meeting which is being held today. The committee also had general oversight of the preparation of the plans and program for the meeting which was held in San Francisco October 18. The detail plans and program for that meeting were perfected by a subcommittee, of which Professor Mulford was chairman.

The program as formulated by the committee for the season's meetings in Washington is now only half carried through. Meetings are planned for the months of February, March, April, and May, and, so far as it is known now, in general the plan of the program can be carried through with only changes here and there of individual papers.

Although it has been possible to secure promises of papers from the men who are as well prepared as any men in the country to present the subjects, it has in several instances been impractical for these men to attend the meetings by reason of their distance from Washington, and sometimes those who could not attend were unable to prepare and forward papers. As a rule, however, this plan of preparing well in advance a program for the year has worked well, has lessened and made more systematic the labors of the committee, and, we believe, has given the Society better prepared papers. It is to be noted from the program of meetings that it has been our aim on certain general subjects to present papers giving various points of view. This plan has also worked well. The full results of the committee's work will not be disclosed until the end of the season, in May.

After careful consideration of the matter, it was decided to hold an annual meeting in Washington on January 22, when it was considered that a considerable number of foresters would be in Washington on other matters, so that a representative attendance could be secured. The large amount of business which has developed and the program which was prepared indicates that the plan of annual meetings is a good one for the Society, and it is recommended that hereafter an annual meeting be held either in Washington or at some other advantageous point.

It is believed desirable for the Society to continue the plan of holding at least one prominent meeting outside of Washington during the year. In 1914 a meeting was held at Ithaca, N. Y., in connection with the opening of the forestry building at Cornell University. The meeting was a success. In October, 1915, occurred the meeting held at the Pan American Exposition at San Francisco. This meeting was instrumental in bringing together a large number of foresters and others interested in forest work, many of whom have had no opportunity heretofore to attend the meetings of the Society. It is believed that the meeting accomplished great good. It is the recommendation of the committee that each year at least one meeting of the kind be held by the Society. During the past year the plan has been followed of holding the meetings in Washington at the homes of the members. The plan has worked well and secured an increased attendance and a deepened interest in the subjects presented. It has also seemed to facilitate social intercourse among the members. It is recommended that this plan be followed until some more advantageous plan of holding the meetings can be found.

WM. L. HALL,
Chairman.

Report of the Committee on Terminology

Toronto, Canada, *January* 3, 1916.

To the President, Society of American Foresters:

I submit herewith a report for the Committee on Terminology, and will now add a few words with regard to what other co-operative work the Society could undertake.

Obviously the advantage of associated effort over that by an individual is that it includes or suggests at least acceptance and agreement among a larger number; hence whatever we would wish or find it desirable to translate into general practice would be work for the Society—standardization of practice in various directions is work which eminently fits this requirement. Of course, the Forest Service, which is practically in greatest need of standards, could be left to specify its own standards; but the profession at large would be benefited, and the Service itself, in my opinion, also, if the standards are agreed to by the large professional public outside the Service—*i. e.*, if the Society produced them. The mere work on such a proposition increases interest in the Society's existence, even if results are small.

Such standardization might be undertaken especially as regards forest survey methods; map-making, including the signs to be used; requirements in construction of growth tables and yield tables, forest fire control, forest planting. I feel, however, that the Forest Service is naturally not only most practically interested, but best equipped to do this work, and that the Society undertaking it takes upon itself a responsibility which it can satisfy only through co-operation with the Forest Service, making, perhaps, useful collected data, which the Service leaves unused, undigested, inaccessible, for one reason or another.

I may add that during my Presidential term I made an effort to launch at least a second committee, namely, on Technical Investigations and Standard Practice, which was to supplant a similar committee planned by the American Forestry Association. Indeed, I appointed the chairman and vice-chairman of such a committee and proposed to add members after a canvass of the Society's membership had given me a clue as to the various interests of members. For this purpose a circular letter was sent out in August, 1914, to the membership; but the returns came in so late, or the compilation of the list was so long retarded, that the end of my Presidential incumbency had arrived before it was completed, and the matter was dropped as far as I was concerned.

At the special open meeting of the Society in Ithaca, May 16, 1914,

a resolution was passed to the effect that committees be appointed to take up questions of nomenclature and terminology, the standardization of scientific methods, and the bringing together of information regarding investigative projects. Prior to this resolution, but in obedience to its spirit, the undersigned, then President of the Society, had on his own initiative appointed a committee of 22 members, divided into five subcommittees, to take up the question of nomenclature and terminology.

The appointment of the committee and its subcommittees was made by letter, dated April 7, 1914.

The proposition was worded as follows:

"It is proposed to revise and explain the forest terminology with a view to securing, as far as possible, uniformity of usage, selecting the terms in use which are preferable, and establishing a synonymy.

"This revision may be based upon Bulletin 61 of the U. S. Forest Service, keeping in mind that this first attempt at a terminology is neither exhaustive nor in some respects acceptable.

"To make the work of a large committee practicable, it would appear desirable to classify by subjects, each subject or class of subjects to be assigned to a small subcommittee for first consideration, its findings to be submitted to a collating committee. The report of this committee is then to be submitted to the whole committee, and the final findings, with appropriate argumentation, to be printed for discussion by the profession at large before final acceptance.

"First, attention should be paid to those terms the use of which is doubtful or not uniform and to those lacking in term value, leaving out of consideration those which appear generally accepted.

"The first duty of each subcommittee should be to assemble the terms in use referring to its particular subject or subjects and report same to collating committee without fear of overlapping, the collating committee acting as reviser.

"The committee is to consist of 19 members from the Society, with three assessors from the Canadian Society of Forest Engineers, thereby giving the decisions an international character.

"It is expected that the chairmen of the subcommittees will do the work, securing from the other members of each subcommittee their criticisms.

"The attention of the members is called especially to the discussion on Terminology to be found in Forestry Quarterly, Volume III, pages 255 and 360, and Volume XII, page 1."

The majority of the committee (12), and especially the chairmen, were chosen from the academic field; the U. S. Forest Service was repre-

sented by six members, and four members came from other, mostly official, positions.

In the pursuit of the work a number of members outside the committee were called into consultation for suggestion and criticism, so that probably twice the number on the committee have been heard from.

Meanwhile the committee, not having finished the work by the end of the year—as was to be expected—was continued with slight changes in personnel by the incoming President, the writer being designated as chairman and especially charged with directing the work of collating the final findings.

The committee as at present constituted consists of the following members: Subsection on Silviculture, Silvics, and Forest Description, S. N. Spring, chairman, H. P. Baker, A. F. Hawes, A. Gaskill, E. H. Frothingham; Subsection on Organization, Mensuration, and Management, A. B. Recknagel, chairman, W. B. Barrows, W. M. Drake, P. S. Lovejoy, T. S. Woolsey, Jr.; Subsection on Utilization and Protection, R. C. Bryant, chairman, I. W. Bailey, B. P. Kirkland; Subsection on Valuation, Administration, and General Terms, A. E. Ziegler, chairman, K. W. Woodward, W. W. White; Collating Committee and Canadian Assessors, B. E. Fernow, chairman, C. D. Howe, Clyde Leavitt, W. N. Millar, Ellwood Wilson, J. H. White.

Since the work of the committees had altogether to be done by correspondence, it entailed a large amount of mechanical work and has proved much more arduous than had been anticipated.

Immediately on their appointment the chairmen, with most commendable enthusiasm, zeal, and assiduity, undertook the arduous work of preparing lists and definitions of terms, submitting these to their committees and to others for criticism, improvement, suggestion, etc., and compiling their views. Progress reports have been made from time to time to the chairman, referred to in Forestry Quarterly, and at present writing the chairman is in receipt of several complete reports of the subcommittees to be submitted to the collating committee, whose function it is to prevent overlapping, remove inconsistencies, amalgamate differences of opinion, and prepare the list of terms on which differences have arisen for submission to the Society at large.

The subcommittee on Silviculture, Silvics, and Forest Description makes a progress report, giving briefly also the method of procedure, which was similar to that of other subcommittees. We quote verbatim:

"The history of the subsection's work is, in brief, as follows:

"1. First draft of terms made in 1914 and early in 1915.

"2. A compilation of first reports submitted by Spring, Gaskill, Hawes, and Frothingham was sent back to members of subsection May 28, 1915.

"3. Criticisms of Dr. Fernow, together with additional criticisms of individual members of committee, sent to each member of subsection August 17, 1915, calling for final vote.

"4. Vote of the members of subsection in process of compilation December, 1915.

"Total number of terms defined = 165 (approximately).

"Total number of terms including cross-references = 225 (approximately).

"The number of terms on which there is division of opinion in the committee are very few and these differences have been or are being harmonized.

"The final compilation will represent the opinions of Forest Service officers, of two State foresters, and of two teachers of forestry, with preliminary criticisms and suggestions from Dr. Fernow. The dictionary form has been deemed best to follow, but a grouping of terms has been planned wherever possible. This will increase cross-references, but will have the advantage of bringing together terms relative to one subject.

"The final report will be completed in January, 1916."

The subcommittee on Forest Organization and Mensuration has compiled and defined a list of 56 terms on the first-named subject and 76 terms under Mensuration; in addition to the two lists, exhibits recording differences of opinion or suggestions by collaborators outside the committee are submitted, referring to 23 terms of the first and 17 terms of the second subject. The chairman finds himself in 18 cases on organization not fully coinciding with the report or with some of the comment, mostly in regard to definitions, only in a few instances in the use of terms. Mensuration terms seem to be much more readily defined, and there exist only a few minor differences.

The subcommittee on Forest Finance, Administration, and General Terms has concentrated its attention on Finance terms and has submitted a report on 65 such terms. It must be admitted that most of these terms can hardly be designated as forestry terms, but are simply general finance terms, such as annual charge, capital, interest expenses, tax income, rent and the various values, the citation of which is only justified whenever special application of them is made to forestry practice. Report on Administration and General Terms is expected to be ready by the end of February, 1916.

The subcommittee on Utilization and Protection has concentrated its attention on the first subject, and with great and painstaking assiduity has collected and defined some 1,030 terms used in logging, 642 terms used in lumber manufacture, and 73 terms used in turpentine orcharding. The list of these terms (about three times as large as that contained in Bulletin 61, and including terms used in Canada) has been made out

on cards and was submitted to a number of expert collaborators inside and outside of the committee for correction and amplification. It is nearly ready for final report, and will be the most complete collection of terms on the subject in existence.

Since this is merely a dictionary record of terms actually used, and there can hardly arise any doubt or difference of opinion or controversy regarding their use, the collating subcommittee would suggest that this work when completed deserves separate publication, and that an effort should be made to induce the U. S. Forest Service to print the same as a Bulletin, submitted by the Society, which would attract the attention and interest of the lumbermen of the country.

It is now proposed for the collating committee to go over terms and definitions, to single out those on which differences of opinion exist, and present, either through the Forestry Quarterly or in special prints, the different views and secure a wider consensus of opinion before a final conclusion is reached, thus giving opportunity not only for the members of the whole committee, but all members of the Society, to be heard.

It will be seen from above reports that substantial progress has been made and the last stage of the work may be confidently expected to be reached presently. The committee would, therefore, ask of the incoming administration of the Society to be continued in its present constitution to enable it to finish its work.

The view has been intimated—nay, directly expressed—that the work of this committee would be futile, since many members would be unwilling to accept the ruling of the committee, and that especially the Forest Service, most interested in uniform usage, might object to apparent dictation. The chairman refuses to believe that such narrow attitude may be expected. If the committee has done its work thoroughly and given good reasons for *recommending,* not dictating, the use of certain terms, a disposition to follow it will readily develop.

In proposing the use of certain terms for certain purposes the committee cannot expect to do more than advise preferences, especially whenever synonyms exist; for language is, after all, a matter in which taste directs, and even in scientific or professional terms synonymy must be recognized and a certain amount of latitude in their use must be granted. *E. g.,* the terms "accretion" and "increment" by derivation and meaning are absolutely synonymous, yet if it is useful and desirable to distinguish them and use each for a purpose of its own, the fact that accretion is nearer in its relation to the verb from which it is derived would make it a convenient term to denote the act of growing and eventually that increase in organic substance which is directly measurable—diameter and

height and possibly form—leaving increment for the calculated result of area and volume. Again, "cutting" and "felling" are as nearly synonymous as can be, yet the former is a more general class word and the latter term is more descriptive of the kind of cutting done in a forest and has more of a term quality. Moreover, cutting is a term used with an entirely different meaning in plant propagation. It is, however, mainly a matter of taste where and when to use the one or the other synonym.

"Expectation" and "expectancy" value are precisely synonymous, but the latter, just because in common language it is rarely used, has a term quality which makes it preferable for such use.

These examples of minor differences are cited merely to indicate the attitude which the committee will take as regards the acceptance of its final report.

Regretting that, owing to the fact that all members of the committee are very busy in other directions, this work could not be finished by the end of your term, as was hoped,

Respectfully submitted,

B. E. Fernow,
Chairman.

Report of Special Committee on Establishment of a Section in Washington

Washington, D. C., *January* 11, 1916.

To the Society of American Foresters:

By letter of December 9 the President of the Society, Mr. Greeley, requested the undersignd to act as a committee to consider the establishing of a Section of the Society at Washington, D. C., and to make recommendations in the matter.

Article VIII of the Constitution of the Society provides that local Sections may be established upon the written petition of 10 or more Active members of the Society. In accordance with this provision, Sections have been established at Missoula, St. Paul, Portland, and Albuquerque. Regular programs of open meetings for the Society as a whole, however, continue to be held each winter at Washington, D. C., notices of these meetings being sent to all members of the Society throughout the country. A feeling has gradually developed among the men located at a distance from Washington, and particularly on the West coast, that the Washington members are receiving the greatest advantages from membership, and that the only benefits to distant members are the published

proceedings and the notices of open meetings, which latter are merely an aggravation to members who have no hope whatever year after year of attending. The fact that the distant members continue to pay the same dues as those residing in the District of Columbia, and in addition that quite a number of them contribute to the support of local sections, adds to the feeling that there is an unequal distribution of benefits. This feeling crystallized into a positive expression of opinion at the meeting of the Society held at San Francisco on October 18, 1915, at which about 35 members were present. The sense of that meeting was that the establishment of a Washington Section on the same basis as other Sections would be very desirable.

In the early days of the Society a very large proportion of the members were engaged in government work, with headquarters at Washington, with the possibility of frequent attendance at the meetings of the Society. Conditions have now changed, however, and only 34 of the 249 Active members now reside in the District of Columbia. Slightly over 50 per cent of the total Active membership of the Society in the continental United States are in the employ of the Federal government, 10 per cent being in the service of various States, 21 per cent being engaged in educational work, and 16 per cent in private pursuits. In addition to the 34 Active and 6 Associate members in the District of Columbia, there are 198 Active and 16 Associate members scattered through 36 States; 34 of these are in the State of California. Seven members in eastern Canada; four in western Canada; three in the Philippines; one in Hawaii; one in Alaska; and one in British North Borneo bring the total number of Active members now in good standing to 249.

Existing conditions seem to indicate that the time has arrived to regard the Society, more than in the past, as a federation of local Sections. It is recommended, therefore, that a Section be established at Washington, D. C., and that the open meetings conducted by this Section replace the series of open meetings now held each winter, under the direction of the Committee on Meetings of the Society, for the following reasons:

(1) The membership of the Society is now so broadly scattered that only a small minority of the members are residents of the District of Columbia or have interests which result in frequent visits to Washington.

(2) It hardly seems appropriate that meetings rarely attended by more than 15 or 20 members should continue to be regarded as the official gatherings of the general Society merely because they are held at Washington, D. C.

(3) To continue the present course would lend color to the assumption that members located at Washington receive special advantages from their membership at no increased cost.

(4) The establishment of a Washington Section would undoubtedly encourage and hasten the establishment of more Sections at other points, thus localizing the Society and stimulating interest in it. This would in turn increase the benefits accruing to members and make the Society a more effective force in advancing the profession of forestry.

(5) There would be a slight saving in expense to the general Society in sending out notices. The present cost of postage and printing necessary to notify all members of the regular open meetings of the Society amounts to about $50.00 per year. If a Washington Section were established, the number of meetings of which all members would have to be notified would be very much smaller.

It is further recommended that the official headquarters of the Society at large remain at Washington, D. C., but that the policy of calling executive or open meetings at other points be even more liberally followed than in the past.

Attached to this report is a draft of a petition for the establishment of a Section at Washington, D. C., together with a draft of proposed by-laws for such a Section. It is recommended that this petition be circulated among the members of the Society resident in the District of Columbia, and that if sufficient signers be secured the petition be acted upon favorably by the Executive Committee.

In case the foregoing action is taken, it is suggested that the attention of all members be called to this development in the organization of the Society by printing this report in the next issue of the Proceedings or otherwise, with the object of encouraging members to affiliate with one of the existing Sections or initiate action toward establishing new ones.

Respectfully submitted.

ALLEN S. PECK,
S. T. DANA,
E. E. CARTER,
Committee.

MEETING OF THE SOCIETY OF AMERICAN FORESTERS IN CONNECTION WITH THE ANNUAL MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

JANUARY 22, 1916.

I attended the annual meeting of the American Association for the Advancement of Science, held at Columbus, Ohio, during the last week of December, 1915. I was somewhat surprised at the number of papers bearing on some phase of forestry which appeared in the programs of the

various sections and affiliated societies. On the whole, however, I left Columbus thoroughly convinced that the work of the profession of forestry as a whole is not now represented in any adequate way at the meetings of the American Association. I understand that the Society of American Foresters has already affiliated with the American Association. It is now a recognized policy of the Society of American Foresters to hold a number of meetings each year outside of Washington. With the gradual enlargement of the Federal and of State services, the establishment of forest schools, and the employment of private foresters, the profession is now so well distributed throughout the United States that it is probable that a good attendance could be secured at almost any meeting which might be held by the American Association. There are many obvious advantages of holding one meeting of the Society of American Foresters each year in connection with the annual meeting of the American Association. One of the primary objects of the Association is to bring together the various scientific societies of the country. A meeting in connection with the Society affords the opportunity to secure for the profession of forestry recognition from scientific men in general of the work we are doing, and it offers to foresters the opportunity to learn in a much more intimate way what other scientific men are doing and to become acquainted with them personally. I believe it would be very desirable if the Society of American Foresters could adopt the plan of holding one meeting each year in connection with the annual meeting of the American Association. At the beginning it would seem best to attempt to offer only a comparatively short program, perhaps not more than half a day or a day at the most. This would permit an exceedingly careful selection of subjects as well as of men to present the subject-matter. Our program should not be long enough to permit the presentation of anything but the best work of the profession. It should aim to include those subjects which represent particularly the scientific side of the development of forestry.

I understand that the annual meeting of the American Association for 1916 will be held in New York city during the last week of December, and that the annual meeting for the year 1917 will be held in Pittsburgh. It will be easy for a large number of foresters to attend a meeting in either place. If the Society decides that it is advisable to hold a meeting in connection with the American Association, I suggest that the program be decided upon sufficiently in advance of the meeting, so that it can be printed in the general program of the American Association. This will secure a much wider distribution of our program among those who will attend the meetings, and undoubtedly result in a much larger attendance at the meeting of the Society.

EARLE H. CLAPP.

Abraham Knechtel

Abraham Knechtel, Forester for the Dominion Parks Branch, died at Ottawa, Ontario, Canada, December 10, 1915. Mr. Knechtel was born at Brussels, Ontario, and was 56 years of age at the time of his death.

In 1900 he graduated from Michigan Agricultural College with the degree of Bachelor of Science. The following year he studied at the New York State College of Forestry, Cornell University, taking the degree of Forest Engineer in 1901. During the succeeding seven years he was connected with the forestry work of the New York State Forest, Fish, and Game Commission, being particularly active in starting the forest nursery and plantation work which has since grown to large proportions. During 1904 he was in charge of the New York State forestry exhibit at the St. Louis Exposition, which work included the establishment of a demonstration nursery and plantation on the exposition grounds. In the same year he was sent by the New York Forest, Fish, and Game Commission to make a study of forest conditions and forestry practice in several European countries.

In 1908 Mr. Knechtel entered the Dominion Forestry Branch, his work being largely in connection with forest planting and fire protection in the prairie provinces of western Canada. In 1913 he became Forester for the Dominion Parks Branch, where for nearly three years he was active in the development and protection of the Canadian National Parks.

During a considerable portion of the more than 14 years of his active service in forestry Mr. Knechtel delivered many lectures on forestry subjects, both in the State of New York and in Canada. He had an unusually artistic sense in connection with photography, and this aided him greatly in the preparation of lantern slides to illustrate his lectures.

Clyde Leavitt.

Members

of

The Society of American Foresters [1]

Active Members

Adams, Bristow, N. Y. State College of Agriculture, Ithaca, N. Y..June 15. 1911
Adams, James Barry. Forest Service, Washington, D. C.....Jan. 1, 1914
Ahern, George Patrick, 2806 Cathedral Ave., Washington, D. C...Jan. 1, 1914
Akerman, Alfred, Greenboro, Ga.....Apr. 2, 1903
Allen, Raymond Walter, Forest Service, Cody, Wyo.....June 15, 1911
Allen, Shirley W., 951 Wescott St., Syracuse, N. Y.....Sept. 1, 1911
Allison, John Howard, University Farm, St. Paul, Minn.....Feb. 18, 1909
Amadon, Clarence Henry, Mebane, N. C.....May 15, 1915
Ames, Fred Elijah, Forest Service, Portland, Oreg.....July 23, 1908
Ashe, William Willard, Forest Service, Washington, D. C.....Mar. 7, 1907
Ayres, Philip Wheelock, 6 Hancock Ave., Boston, Mass.....Mar. 7, 1907

Bailey, Irving Widmer, Bussey Bldg., Jamaica Plain, Mass.....Apr. 1, 1914
Baker, Hugh Potter, N. Y. State Col. of Forestry, Syracuse, N. Y.Mar. 7, 1907
Baker, James Frederick, N. Y. State Col. of For., Syracuse, N. Y..Feb. 15, 1913
Balthis, Russell F., Forest Service, Cloudcroft, N. Mex.....June 15, 1911
Bard, George Philip, 800 Penn St., Reading, Pa.....June 15, 1911
Barrows, William Burnet, Forest Service, Washington, D. C.....June 15, 1911
Bates, Carlos Glazier, Forest Service, Denver, Colo.....Mar. 24, 1910
Benedict, Junius St. James, Forest Service, Gorham, N. H.....Feb. 15, 1913
Berry, Swift, Forest Service, San Francisco, Cal.....Sept. 1, 1911
Besley, Fred Wilson, Johns Hopkins Univ., Baltimore, Md.....July 23, 1908
Billard, Frederick Howell, c/o Lyon & Billard Co., Meriden, Conn.Feb. 15, 1913
Birch, Dwight C., Forest Service, Northfork, Cal.....Nov. 18, 1915
Brewster, Donald Ross, Forest Service, Priest River, Idaho.....July 1, 1914
Briscoe, John Manvers, University of Maine, Orono, Me.....Apr. 1, 1914
Bristol, Harold Russell, c/o Delaware & Hudson Co., Plattsburgh, N. Y.....Feb. 15, 1913
Brown, Nelson Courtlandt, N. Y. State Col. of For., Syracuse, N. Y.Feb. 15, 1913
Bruce, Donald, Dept. of Forestry, Univ. of Cal., Berkeley, Cal....Feb. 15, 1913
Bruce, Eugene Sewell, Forest Service, Washington, D. C.....Jan. 1, 1914
Bruins, John Franklin, Forest Service, Pocatello, Idaho.....July 23, 1908
Bryant, Edward Sohier, Forest Service, Washington, D. C.....Feb. 15, 1913
Bryant, Ralph Clement, Yale Forest School, New Haven, Conn..Apr. 2, 1903
Burns, Findley, Forest Service, Washington, D. C.....Feb. 18, 1909
Burrall, Harrison Dewitt, Forest Service, Albuquerque, N. Mex..June 15, 1911
Butler, Ovid McOuat, Forest Service, Albuquerque, N. Mex.....June 15, 1911

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[1] This list is incomplete as to given names of several members and as to certain dates. Members will accordingly confer a favor on the Secretary if they will furnish him with any of these data.

Calkins, Hugh Gilman, Forest Service, Albuquerque, N. Mex.....June 15, 1911
Canavarro, Georges de Sousa, National Museum, Washington, D. C.Apr. 1, 1914
Carter, Edward Edgecombe, Forest Service, Washington, D. C....June 15, 1911
Cary, Austin, Forest Service, Washington, D. C.....Mar. 2, 1905
Chaffee, Reginald Roscoe, Pa. State College, State College, Pa...Apr. 1, 1914
Chandler, Bernard Albert, c/o State Forester, Burlington, Vt....May 15, 1915
Chapman, Herman Haupt, Yale Forest School, New Haven, Conn.Mar. 7, 1905
Cheyney, Edward Gheen, University Farm, St. Paul, Minn.....May 21, 1908
Chittenden, Alfred Knight, East Lansing, Michigan.....Apr. 2, 1903
Clark, Ernest Dwight, Forest Service, Woodstock, Va.....June 15, 1911
Clapp, Earle Hart, Forest Service, Washington, D. C.....Mar. 7, 1907
Clark, Elias Treat, Forest School, Univ. of Wash., Seattle, Wash..June 15, 1911
Clark, Judson F., 520 Vancouver Block, Vancouver, B. C.....July 23, 1908
Clark, William Darrow, Mass. Agr. College, Amherst, Mass.....Feb. 15, 1913
Clement, George Edward, 275 Warren St., Boston, Mass.....Apr. 2, 1903
Clifford, Edward C., R. F. D. No. 1, Woodfords, Me.....Mar. 24, 1910
Coffman, John Daniel, Forest Service, Weaverville, Cal.....Sept. 1, 1911
Cohoon, Anson E., Forest Service, Portland, Oreg.....Apr. 28, 1909
Cook, Arthur Mayhew, Forest Service, Steamboat Springs, Colo..June 15, 1911
Cook, Harold O., State Forester's Office, Boston, Mass.....Feb. 15, 1913
Coolidge, Philip Tripp, State House, Trenton, N. J.....June 15, 1911
Cox, William Thomas, State Forester, St. Paul, Minn.....Mar. 1, 1906
Cromie, George Alexander, 80 Water St., New Haven, Conn.....May 15, 1915
Crowell, Lincoln, Indian Service, Cherokee, N. C.....Apr. 1, 1914
Curran, Hugh McCollum, 1601 S. Main St., Winston-Salem, N. C..Mar. 7, 1905

Dana, Samuel Trask, Forest Service, Washington, D. C.....Apr. 28, 1909
Detweiler, Samuel Bertolet, Morton, Pa.....Mar. 7, 1907
Drake, Willard M., Univ. of Montana, Missoula, Mont.....June 15, 1911
DuBois, Coert, Forest Service, San Francisco, Cal.....May 28, 1903
Dunlap, Frederick, Univ. of Missouri, Columbia, Mo.....June 6, 1907
Dunston, Clarence E., Indian Service, Washington, D. C.....June 15, 1911
Dwight, Theodore Woolsey, Forestry Branch, Ottawa, Canada....May 15, 1915

Eldredge, Inman F., Forest Service, Pensacola, Fla.....June 15, 1911
Erickson, Martin Lewis, Forest Service, Medford, Oreg.....June 23, 1908
Evans, Oscar Montgomery, Forest Service, Placerville, Cal.....May 17, 1915

Farquhar, Henry H., 1137 Massachusetts Ave., Cambridge, Mass..July 1, 1914
Ferguson, John Arden, Pa. State College, State College, Pa.....June 15, 1911
Fernow, Bernhard Eduard, Univ. of Toronto, Toronto, Canada...Dec. 15, 1900
Fetherolf, James Milton, Forest Service, Ogden, Utah.....Mar. 1, 1906
Filley, Walter Owen, 144 Whalley Ave., New Haven, Conn.....June 15, 1911
Fisher, Richard Thornton, Harvard Forest School, Jamaica Plain, Mass. .....Apr. 2, 1903
Foley, John, 413 Oak Lane, Wayne, Pa.....Jan. 2, 1902
Foster, Harold Day, Forest Service, Medford, Oreg.....June 15, 1911
Foster, John Harold, A. & M. College, College Station, Texas....Mar. 24, 1910
Foxworthy, Fred William, Bureau of Forestry, Los Banos, Laguna, Luzon, P. I.....June 15, 1911

Fromme, Rudo Lorenzo, Forest Service, Olympia, Wash.....Feb. 18, 1909
Frothingham, Earl Hazeltine, Forest Service, Washington, D. C..July 23, 1908

Gaskill, Alfred, State House, Trenton, N. J.....May 28, 1903
Gaylord, Frederick Alan, Nehasane Park, Nehasane, N. Y.....June 15, 1911
Gifford, John Clayton, Cocoanut Grove, Dade Co., Fla.....Apr. 3, 1902
Goldsmith, Belknap Chittenden, Forest Service, Alturas, Cal....Sept. 1, 1911
Graff, Herbert, Forest Service, McCall, Idaho.....June 15, 1911
Granger, Christopher Mabley, Forest Service, Denver, Colo.....Feb. 15, 1913
Graves, Henry Solon, Forest Service, Washington, D. C.....Dec. 13, 1900
Greeley, William Buckhout, Forest Service, Washington, D. C....Feb. 3, 1906
Griffith, Edward Merriam, c/o Taggerts Paper Co., Watertown, N. Y. .....Dec. 15, 1900
Guthrie, John Dennett, Forest Service, Flagstaff, Ariz.....Mar. 7, 1907

Hall, Rufus Clifford, Forest Service, Washington, D. C.....June 15, 1911
Hall, William Logan, Forest Service, Washington, D. C.....Dec. 13, 1900
Hammatt, Richard Fox, Forest Service, Sisson, Cal.....Sept. 1, 1911
Harris, Philip Talbot, Forest Service, Tacoma, Wash.....Feb. 18, 1909
Hatton, John Henry, Forest Service, Denver, Colo.....Mar. 2, 1905
Hawes, Austin Foster, State Forester, Burlington, Vt.....Mar. 2, 1905
Hawley, Ralph Chipman, Yale Forest School, New Haven Conn..Feb. 3, 1906
Hazard, James Ovington, R. F. D., Tuckahoe, N. J.....May 15, 1915
Headley, Roy, Forest Service, San Francisco, Cal.....Apr. 15, 1915
Hill, Cary Leroy, 4416 Pleasant Valley Court, Oakland, Cal.....June 6, 1907
Hirst, Edgar Clarkson, State Forester, Concord, N. H.....June 15, 1911
Hodge, William Churchill, Jr., Forest Service, San Francisco, Cal.Apr. 2, 1903
Hodson, Elmer Reed, Forest Service, Washington, D. C.....Mar. 7, 1907
Holmes, John Simcox, Chapel Hill, N. C.....June 6, 1907
Hopkins, Arthur Sherwood, c/o Conservation Com., Albany, N. Y.Apr. 1, 1914
Hopping, Ralph, Forest Service, San Francisco, Cal.....June 15, 1915
Hosmer, Ralph Sheldon, Cornell University, Ithaca, N. Y.....Dec. 13, 1900
Howard, William Gibbs, Conservation Com., Albany, N. Y.....June 15, 1911
Howe, Clifton Durant, Univ. of Toronto, Toronto, Canada.....May 15, 1915

Imes, Richard Perry, Forest Service, Custer, S. Dak.....Mar. 7, 1907

Jack, John George, East Walpole, Mass.....Jan. 1, 1914
Jackson, Alexander Grant, Forest Service, Seattle, Wash.....Feb. 15, 1913
Jardine, James Tertius, Forest Service, Washington, D. C.....Jan. 1, 1914
Jones, Richard Chapin, Univ. of Virginia, Charlottesville, Va.....July 1, 1914
Jotter, Ernst Victor, Forest Service, Weaverville, Cal.....May 15, 1915
Judd, Charles Sheldon, 2066 Lauihuli Drive, Honolulu, Hawaii..Mar. 24, 1910

Keach, John Everett, Forest Service, Missoula, Mont.....June 6, 1907
Kelleter, Paul Delmar, Forest Service, Deadwood, S. Dak.....Feb. 18, 1909
Kellogg, Francis Bentley, Forest Service, Pendleton, Oreg.....Feb. 15, 1913
Kellogg, Royal Shaw, 925 Central Ave., Wilmette, Ill.....Mar. 7, 1905
Kempfer, William Herbert, Deer Park, Fla.....Feb. 15, 1913

Kent, William H. B., Cazenovia, N. Y. ..... Apr. 28, 1909
Kiefer, Francis, Forest Service, Harrison, Ark. ..... June 15, 1911
Kinney, David Golden, 453 Holland Ave., Highland Park, Los Angeles, Cal. ..... July 23, 1908
Kinney, Jay P., Indian Office, Washington, D. C. ..... Feb. 15, 1913
Kircher, Joseph Casimir, Albuquerque, N. Mex. ..... Apr. 1, 1915
Kirkland, Burt Persons, Dept. of Forestry, Univ. of Washington, Seattle, Wash. ..... Feb. 18, 1909
Kneipp, Leon Frederick, Forest Service, Ogden, Utah ..... Jan. 1, 1914
Koch, Elers, Forest Service, Missoula, Mont. ..... Mar. 7, 1905
Krauch, Hermann, Porvenir, San Miguel Co., N. Mex. ..... May 15, 1915
Kümmel, Julius F., Forest Service, Portland, Oreg. ..... Mar. 24, 1910
Kupfer, Carl Albert, Forest Service, San Francisco, Cal. ..... June 15, 1911

Lafon, John, Jr., c/o Minister of Lands, Victoria, B. C. ..... Feb. 15, 1913
Larsen, Louis T., Forest Service, San Francisco, Cal. ..... May 18, 1915
Leavitt, Clyde, c/o Conservation Com., Ottawa, Canada ..... July 23, 1908
Leopold, Aldo, Forest Service, Albuquerque, N. Mex. ..... Feb. 15, 1913
Lovejoy, Parish Storrs, 1137 Fair Oaks, Ann Arbor, Mich. ..... June 15, 1911

Macdonald, Gilmore B., Iowa Exp. Sta., Ames, Iowa ..... June 15, 1911
Macduff, Nelson Ferris, Forest Service, Grants Pass, Oreg. ..... June 15, 1911
Mackaye, Benton, Forest Service, Washington, D. C. ..... June 15, 1911
McKibbin, Clifford W., Forest Service, Tucson, Ariz. ..... May 15, 1915
McLean, Forman Taylor, c/o Philippine Bureau of Forestry, Manila, P. I. ..... June 15, 1911
Maddox, Rufus Sherrell, c/o State Forester, Nashville, Tenn. ..... Sept. 1, 1911
Marston, Roy Leon, Skowhegan, Me. ..... May 28, 1903
Martin, Clyde Sayers, Lock Box 643, Montesano, Wash. ..... Apr. 1, 1914
Mason, Davis Townsend, Univ. of California, Berkeley, Cal. ..... Mar. 24, 1910
Mast, William Herbert, Davenport, Iowa ..... July 23, 1908
Mathews, Donald M., British North Borneo Co., Sandacan, British North Borneo ..... Feb. 15, 1913
Maule, William M., Forest Service, Gardnerville, Nev. ..... Feb. 18, 1909
Meinecke, Emile P., Forest Service, San Francisco, Cal. ..... Jan. 1, 1914
Merritt, Melvin L., Forest Service, Bend, Oreg. ..... Feb. 15, 1913
Millar, Willis Norman, Faculty of Forestry, 11 Queens Park, Toronto, Canada ..... Sept. 1, 1911
Miller, Francis Garner, Wash. State College, Pullman, Wash. ..... Mar. 5, 1904
Mitchell, John Alfred, Experiment Sta., Quincy, Cal. ..... Sept. 1, 1911
Moody, Frank Benjamin, State Forester, Madison, Wis. ..... Feb. 18, 1909
Moon, Frederick Franklin, N. Y. State College of Forestry, Syracuse, N. Y. ..... June 15, 1911
Moore, Barrington, 925 Park Ave., New York City ..... June 15, 1911
Moore, Sydney Luard, 4 East Bay St., Jacksonville, Fla. ..... May 21, 1908
Moore, Walter Morrison, Forest Service, Pactola, S. Dak. ..... June 15, 1911
Morbeck, George Chester, State College, Ames, Iowa ..... Apr. 1, 1914
Morrell, Fred W., State Forester, Fort Collins, Colo. ..... July 23, 1908
Mulford, Walter, Univ. of California, Berkeley, Cal. ..... Mar. 5, 1904

Munger, Thornton Taft, Forest Service, Portland, Oreg.....Mar. 24, 1910
Murphy, Louis Sutliffe, Forest Service, Washington, D. C.....Mar. 24, 1910

Neel, Harry Camble, Dravosburg, Pa.....July 23, 1908
Nelson, John Marburg, P. & R. C. & I. Co., Pottsville, Pa.....June 6, 1907
Newins, Harold Stephenson, Oreg. Agric. Col., Corvallis, Oreg...May 15, 1915
Notestein, Frank Browning, Forest Service, Laramie, Wyo.....July 1, 1914

Olmsted, Frederick Erskine, Sausalito, Marin Co., Cal.....Dec. 15, 1900
Oman, Andrew Edward, Forest Service, Weiser, Idaho.....May 21, 1908

Parker, Rutledge, Forest Service, Missoula, Mont.....July 1, 1914
Pearson, Gustav Adolph, Forest Service, Flagstaff, Ariz.....Mar. 24, 1910
Peavy, George Wilcox, Oreg. Agric. Col., Corvallis, Oreg.....Mar. 1, 1906
Peck, Allen Steele, Forest Service, Washington, D. C.....June 6, 1907
Peters, James Girvin, Forest Service, Washington, D. C.....Mar. 7, 1905
Pettis, Clifford Robert, Conservation Com., Albany, N. Y.....July 23, 1908
Pinchot, Gifford, 1212 Real Estate Tr. Bldg., Philadelphia, Pa....Dec. 13, 1900
Piper, William Bridge, Forest Service, East Tawas, Mich.....June 15, 1911
Potter, Albert Franklin, Forest Service, Washington, D. C.....June 15, 1911
Pratt, Merritt Berry, Forest Service, Nevada City, Cal.....July 23, 1908
Preston, John F., Forest Service, Missoula, Mont.....June 15, 1911

Ramskill, Jerome Hinds, Forest Service, Delta, Colo.....June 15, 1911
Read, Arthur Davis, Senorito, N. Mex.....Feb. 18, 1909
Recknagel, Arthur Bernard, College of Agriculture, Cornell University, Ithaca, N. Y.....May 21, 1908
Redington, Paul Goodwin, Forest Service, Northfork, Cal.....Feb. 3, 1906
Reed, Franklin Weld, Forest Service, Washington, D. C.....Mar. 5, 1904
Reynolds, Robert van Rensselaer, Forest Service, Wash., D. C....June 15, 1911
Riley, Smith, Forest Service, Denver, Colo.....Mar. 2, 1905
Ringland, Arthur Cuming, Forest Service, Albuquerque, N. Mex..July 23, 1908
Rockwell, Frank I., Forest Service, Cœur d'Alene, Idaho.....Sept. 1, 1911
Rogers, David Nathan, Forest Service, Quincy, Cal.....Sept. 1, 1911
Roth, Filibert, University of Michigan, Ann Arbor, Mich.....Dec. 15, 1900
Rothery, Julian Eastman, 527 Fifth Ave., New York, N. Y.....June 15, 1911
Rothkugel, Max, Florica 524, Officina de Bosques, Buenos Aires, Argentina .....July 23, 1908

Sackett, Homer S., 629 Federal Bldg., Chicago, Ill.....June 15, 1911
Schenck, Carl Alwin, Darmstadt, Germany.....Dec. 15, 1900
Schwarz, George Frederick, 1470 Beacon St., Brookline, Mass....Jan. 2, 1902
Scott, Charles Anderson, Agricultural College, Manhattan, Kans..Mar. 1, 1906
Sewall, James Wingate, Oldtown, Me.....May 15, 1915
Shepard, William Chambers, R. F. D. 59, Berlin, Conn.....June 15, 1911
Sherfesee, William Forsythe, Bureau of Forestry, Manila, P. I...Mar. 7, 1907
Sherrard, Thomas Herrick, Forest Service, Portland, Oreg.....Dec. 13, 1900
Shinn, Charles Howard, Forest Service, Northfork, Cal.....Mar. 7, 1907
Siecke, Eric Otto, Salem, Oreg.....July 23, 1908

Silcox, Ferdinand Augustus, Forest Service, Missoula, Mont.....June 6, 1907
Skeels, Dorr, Forest School, Univ. of Montana, Missoula, Mont...Sept. 1, 1911
Smith, Clinton Gold, Forest Service, Ogden, Utah.....Feb. 18, 1909
Smith, Charles Stowell, Forest Service, San Francisco, Cal.....Mar. 24, 1910
Smith, Percy T., Deadwood, S. Dak.....May 15, 1915
Smith, Stanton Gould, 430 Henry Bldg., Seattle, Wash.....Feb. 18, 1909
Spaulding, Thomas Claude, Forest School, University of Montana, Missoula, Mont.....July 1, 1914
Sponsler, Octavius Lee, Univ. of Michigan, Ann Arbor, Mich.....June 15, 1911
Spring, Samuel Newton, Col. of Agr., Cornell Univ., Ithaca, N. Y.Mar. 5, 1904
Stabler, Herbert Osburn, Forest Service, Washington, D. C.....July 23, 1908
Stephen, John Wallace, 1031 Euclid Ave., Ithaca, N. Y.....June 15, 1911
Sterling, Ernest Albert, 925 Commercial Trust Bldg., Phila., Pa..Apr. 2, 1903
Sterrett, William Dent, Forest Service, Washington, D. C.....Feb. 3, 1906
Stuart, Robert Young, Forest Service, Washington, D. C.....June 15, 1911
Sudworth, George Bishop, Forest Service, Washington, D. C.....Dec. 15, 1900
Swann, Orrington Thomas, Oshkosh, Wis.....Sept. 1, 1911

Terry, Elwood Idell, Colorado College, Colorado Springs, Colo...Sept. 1, 1911
Tiemann, Harry Donald, Forest Service, Madison, Wis.....Mar. 2, 1905
Tierney, Dillon Parnell, Asst. State Forester, St. Paul, Minn.....June 15, 1911
Tillotson, Claude Raymond, Forest Service, Washington, D. C...June 15, 1911
Tompkins, Harry James, Forest Service, San Francisco, Cal.....Jan. 2, 1902
Toumey, James William, Yale Forest School, New Haven, Conn..Dec. 15, 1900

Upson, Arthur T., Hot Sulphur Springs, Colo.....Apr. 1, 1914

Viles, Blaine Spooner, Augusta Trust Bldg., Augusta, Me.....July 23, 1908
Von Bayer, William Hector, Indian Office, Washington, D. C....May 21, 1908

Waha, Alpheus Oliver, Forest Service, Albuquerque, N. Mex.....May 21, 1908
Warner, Joseph De Witt, Forest Service, Livingston, Mont.....July 23, 1908
Weber, William Hoyt, 151 Courtland Ave., Stamford, Conn.....June 15, 1911
Weigle, William Grant, Forest Service, Ketchikan, Alaska.....Feb. 3, 1906
Weiss, Howard Frederick, Forest Service, Madison, Wis.....June 6, 1907
Wentling, John Philip, Univ. of Minnesota, St. Paul, Minn.....July 23, 1908
White, Edgar Fowler, Forest Service, Missoula, Mont.....July 1, 1914
White, J. H., University of Toronto, Toronto, Canada.....May 15, 1915
Wilber, Charles Parker, State House, Trenton, N. J.....June 15, 1911
Whitford, Harry Nichols, Forest Branch, Victoria, B. C.....Sept. 1, 1911
Williams, Asa Starkweather, 503 Winch Bldg., Vancouver, B. C...Apr. 28, 1909
Willis, Clarence B., Forest Service, Portland, Oreg.....Feb. 15, 1913
Wilson, Elwood, c/o Laurentide Paper Co., Grand Mere, P. Q., Canada .....May 15, 1915
Winkenwerder, Hugo, University of Washington, Seattle, Wash...Sept. 1, 1911
Wirt, George H., Department of Forestry, Harrisburg, Pa.....Mar. 24, 1910
Woodbury, Truman Doane, Forest Service, San Francisco, Cal....July 23, 1908
Woodward, Karl Wilson, New Hampshire College, Durham, N. H..Feb. 3, 1906
Woolsey, Theodore Salisbury, Jr., Albuquerque, N. Mex.....Mar. 7, 1905
Worthley, Irving Tupper, Broad Street Station, Philadelphia, Pa..June 15, 1911

Ziegler, Edwin Allen, Mont Alto, Pa.....June 6, 1907
Zon, Raphael, Forest Service, Washington, D. C.....Mar. 5, 1904

Associate Members

Betts, Harold Scofield, Forest Service, Washington, D. C.....July 23, 1908
Bonner, Frank E., Forest Service, Missoula, Mont.....July 1, 1914
Burns, George P., University of Vermont, Burlington, Vt.....July 1, 1914
Clement, Frederick Edward, Univ. of Minn., Minneapolis, Minn...Feb. 15, 1913
Coville, Frederick Vernon, Bureau of Plant Industry, Wash., D. C.Dec. 13, 1900
Egleston, Nathaniel Hillyer, Jamaica Plain, Mass.....Feb. 7, 1901
Fenn, Frank Alfred, 419 Eddy Ave., Missoula, Mont.....July 23, 1908
Herty, Charles Holmes, Univ. of North Carolina, Chapel Hill, N. C.Apr. 26, 1905
Humphrey, Clarence John, Forest Products Lab., Madison, Wis..Feb. 15, 1913
Johnson, Don P., Forest Service, Santa Fe, N. Mex.....July 1, 1914
Lamb, George Newton, Forest Service, Washington, D. C.....Feb. 15, 1913
Lukens, Theodore P., Pasadena, Cal.....Apr. 26, 1905
Miller, John M., Forest Service, Ashland, Oreg.....Sept. 1, 1911
Myers, George Hewitt, 2310 S St., Washington, D. C.....Apr. 1, 1914
Merriam, Clinton Hart, Lagunitas, Cal.....Jan. 2, 1902
Metcalf, Haven, Bureau of Plant Industry, Washington, D. C....June 15, 1911
Pitchlynn, Paul P., Forest Service, Albuquerque, N. Mex.....May 15, 1915
Rhodes, J. E., Interstate Bank Bldg., New Orleans, La.....Feb. 15, 1913
Sampson, Arthur William, Forest Service, Ephraim, Utah.....Apr. 1, 1914
Smith, Herbert Augustine, Forest Service, Washington, D. C.....Jan. 1, 1914
Webb, William Seward, Shelburne, Vt.....Jan. 3, 1901
Weir, James R., First National Bank Bldg., Missoula, Mont.....July 1, 1914
Wells, Philip Patterson, Metropolitan Bank Bldg., Wash., D. C...July 23, 1908
Winn, Frederick, Springerville, Ariz.....Apr. 1, 1914
Woodruff, George Washington, 1 Broadway, New York, N. Y....Mar. 14, 1905

Honorary Members

Andrews, Christopher Columbus, State Fire Warden, St. Paul, Minn. .....Jan. 1, 1914
Bowers, Edward Augustus, Yale Forest School, New Haven, Conn.Jan. 1, 1914
Clutterbuck, Philip Henry, F. Z. S., F. R. G. S., F. E. S., Deputy Conservator of Forests, Naini Tal, India.....Mar. 24, 1910
Elliott, Simon Bolivar, Reynoldsville, Pa.....Jan. 1, 1914
Francis, David Rowland, St. Louis, Mo.....Jan. 1, 1914
Hague, Arnold, Geological Survey, Washington, D. C.....Jan. 1, 1914
Newell, Frederick Haynes, 1109 California St., Urbana, Ill.....Jan. 1, 1914
Noble, John Willock, St. Louis, Mo.....Jan. 1, 1914
Roosevelt, Theodore, Oyster Bay, N. Y.....Jan. 1, 1914
Sargent, Charles Sprague, Jamaica Plain, Mass.....Jan. 1, 1914
Spaulding, Volney Morgan, Loma Linda, Cal.....Jan. 1, 1914
Walcott, Charles Doolittle, Smithsonian Institution, Wash., D. C..Jan. 1, 1914
Waldo, John Breckenridge, Macleay, Oreg.....Jan. 1, 1914
Wilson, James.....Jan. 1, 1914

Deceased Members

Name	Membership	Date of election	Date of death
Bessey, Charles Edwin	Honorary	Jan. 2, 1902	Feb. 27, 1915
Black, Frank Swett	Associate	Jan. 3, 1901	Mar. 16, 1913
Brandis, Sir Dietrich	Honorary	May 28, 1903	May 28, 1907
Brewer, William Henry	Associate	Feb. 7, 1901	Nov. 2, 1910
Clark, Willard Weld	Active	Apr. 2, 1903	July 30, 1909
Cleveland, Grover	Associate	Jan. 3, 1901	June 24, 1908
Dudley, William Russell	Associate	Feb. 7, 1901	June 4, 1911
Fox, William Freeman	Associate	Dec. 13, 1900	June 16, 1909
Furnas, Robert Wilkinson	Associate	Jan. 2, 1902	—— —, 1905
Gardner, Wesley Johnson	Active	Mar. 5, 1904	June 14, 1906
Gibbs, Wolcott	Associate	Apr. 3, 1902	Dec. 9, 1908
Harrison, Benjamin	Associate	Jan. 3, 1901	Mar. 14, 1901
Hitchcock, Ethan Allen	Associate	Apr. 3, 1902	Apr. 9, 1909
Holmes, Joseph Austin	Honorary	Jan. 1, 1914	July 13, 1915
Hubbard, William Fairchild	Active	May 28, 1903	July 17, 1905
Jesup, Morris Ketchum	Associate	Apr. 3, 1902	Jan. 22, 1908
Knechtel, Abraham	Active	Mar. 1, 1906	Dec. 10, 1915
Margolin, Louis	Active	Feb. 3, 1906	June 20, 1914
Miller, Louis Christian	Active	Mar. 7, 1905	July 16, 1910
Mohr, Charles	Associate	Feb. 7, 1901	Apr. 27, 1902
Morton, Julius Sterling	Associate	Jan. 2, 1902	Apr. 27, 1902
Murdock, John, Jr.	Active	June 15, 1911	Jan. 29, 1915
Phillips, Frank Jay	Active	July 23, 1908	Feb. 13, 1911
Pinchot, James Warren	Associate	Jan. 3, 1901	Feb. 7, 1908
Plummer, Fred Gordon	Active	July 23, 1908	Aug. 15, 1913
Price, Overton Westfeldt	Active	Dec. 13, 1900	June 11, 1914
Rogers, Robert Lansing	Active	June 15, 1911	May 25, 1915
Vanderbilt, George Washington	Associate	Feb. 7, 1901	Mar. —, 1914
Whitney, William Collins	Associate	Jan. 3, 1901	Feb. 2, 1904
Wiggins, Benjamin Lawton	Associate	Jan. 3, 1901	June 14, 1909

Active Members by States and Character of Service

States.	Federal service.	State and municipal service.	Private work.	Educational work.	Total.
Northeastern U. S.:					
Maine	.....	.....	4	1	5
New Hampshire	1	1	.....	1	3
Vermont	.....	2	.....	.....	2
Massachusetts	1	1	3	4	9
Connecticut	.....	2	2	4	8
New York	.....	3	8	9	20
New Jersey	.....	3	1	.....	4
Pennsylvania	.....	1	6	4	11

States.	Federal service.	State and municipal service.	Private work.	Educational work.	Total.
Southeastern U. S.:					
Maryland	.....	1	.....	.....	1
District of Columbia	35	.....	1	.....	36
Virginia	1	1	.....	.....	2
North Carolina	.....	1	2	.....	3
Georgia	.....	.....	.....	1	1
Florida	2	.....	2	.....	4
Missouri	.....	.....	.....	1	1
Tennessee	.....	1	.....	.....	1
Texas	.....	1	.....	.....	1
Lake States:					
Illinois	1	.....	1	.....	2
Michigan	1	.....	.....	4	5
Wisconsin	3	1	1	.....	5
Minnesota	.....	2	.....	3	5
Middle Western U. S.:					
Iowa	.....	.....	1	3	4
Arkansas	1	.....	.....	.....	1
South Dakota	3	.....	.....	.....	3
Kansas	.....	.....	.....	1	1
Northwestern U. S.:					
Montana	7	.....	.....	3	10
Idaho	5	.....	.....	.....	5
Wyoming	1	.....	.....	.....	1
Colorado	7	1	.....	1	9
Southwestern U. S.:					
Arizona	3	.....	.....	.....	3
New Mexico	8	.....	2	.....	10
Utah	4	.....	.....	.....	4
Nevada	1	.....	.....	.....	1
Pacific Coast States:					
Washington	4	.....	1	4	9
Oregon	10	1	.....	2	13
California	25	.....	3	4	32
Total for continental U. S.	124	23	38	50	235
Non-contiguous U. S.:					
Alaska	1	.....	.....	.....	1
Hawaii	.....	1	.....	.....	1
Philippines	3	.....	.....	.....	3
Canada:					
Eastern	2	.....	1	4	7
Western	2	.....	2	.....	4
British North Borneo	.....	.....	.....	1	1
Germany	1	.....	.....	.....	1
Grand total	133	24	41	55	253

Constitution as Amended to Date

ARTICLE I

NAME

The name of this Society shall be The Society of American Foresters.

ARTICLE II

OBJECT

The object of this Society shall be to further the cause of forestry in America by fostering a spirit of comradeship among foresters; by creating opportunities for a free interchange of views upon forestry and allied subjects; and by disseminating a knowledge of the purpose and achievements of forestry.

ARTICLE III

MEMBERSHIP

Section 1. Members may be Active, Associate, or Honorary.

Sec. 2. Active members shall be professional foresters of achievement, whose field of work lies within the United States or its possessions or within the Dominion of Canada.

Sec. 3. Associate members shall be persons of achievement in lines of work closely related to forestry who have shown substantial interest in American forestry. They may attend all meetings of the Society and take part in its discussions, but shall not be entitled to vote.

Sec. 4. Honorary members shall be chosen from those who have rendered distinguished service to forestry either in America or abroad, and from professional foresters of achievement whose field of work lies outside of the United States and its possessions and the Dominion of Canada. They may attend all meetings of the Society and take part in its discussions, but shall not be entitled to vote.

Sec. 5. Any Active member may propose names of candidates for Active, Associate, or Honorary membership. Such names shall be submitted in writing to the Committee on Admissions, accompanied by a brief biographical sketch, giving the qualifications of the candidate for admission to the Society. The names of all candidates proposed shall be referred to all Active members of the Society for comment or protest at least two months before final action is taken by the Committee on Admissions. The Committee on Admissions will then decide what candidates

shall be elected, six affirmative votes being necessary to admit any candidate to membership in the Society.

SEC. 6. Charges of conduct unbecoming a member may be preferred by any Active or Associate member. Such charges shall be made in writing to the Committee on Admissions, which shall without delay investigate them and submit its findings in writing, with the evidence on which they are based, to a board consisting of the President, Vice-President, and Executive Committee of the Society for final action. A vote of at least five members of this board will be necessary to suspend, enforce the resignation of, or expel the member in question.

ARTICLE IV

OFFICERS

SECTION 1. The officers of this Society shall be a President, a Vice-President, a Secretary, and a Treasurer.

SEC. 2. The officers shall be elected, as hereinafter provided in Article V, Section 2, from the Active members by letter-ballot at the first executive meeting of the calendar year, and shall serve one year, or until their successors are elected.

SEC. 3. The President shall preside at the meetings of the Society, shall appoint the committees hereinafter designated, and shall perform all other duties incident to his office.

SEC. 4. In the absence of the President, the Vice-President shall preside at the meetings of the Society.

SEC. 5. The Secretary shall keep the minutes of the Society, shall conduct its correspondence, shall announce its meetings, and shall be custodian of its permanent records.

SEC. 6. The Treasurer shall collect all moneys due the Society and have custody of all moneys received. He shall deposit and expend the latter only in such manner as the Executive Committee shall direct.

ARTICLE V

COMMITTEES

SECTION 1. The standing committees, composed of Active members, shall be an Executive Committee, Committee on Admissions, Committee on Meetings, and an Editorial Board. Members of the Executive Committee shall be elected by the Society, as hereinafter provided, and shall serve for five years, or until their successors are elected. Members of the other standing committees shall be appointed by the President, as hereinafter provided, and shall serve for one year, or until their successors

are appointed. Elections to the Executive Committee shall be made at the first executive meeting of the calendar year, and appointments to the other standing committees at that meeting, or as soon thereafter as possible.

SEC. 2. The Executive Committee shall consist of five (5) members, and shall choose its own chairman. Members of the committee shall be elected by letter-ballot, one member being elected each year. Three (3) members shall constitute a quorum. This committee shall control all funds, and shall perform any other executive duties delegated to it by the Society. The Executive Committee, before each annual meeting, shall appoint a nominating committee of three (3) Active members of the Society, whose duty it shall be to make not less than two (2) nor more than three (3) nominations for each of the officers and for a member on the Executive Committee. These nominations shall be submitted to the active membership of the Society not more than twelve (12) nor less than four (4) weeks before the annual meeting. Other nominations, if signed by at least ten (10) members and presented to the Secretary in writing at least four (4) weeks before the annual meeting, shall also be submitted to the membership on the official ballot. The candidate receiving the highest number of votes for each office shall be declared elected. The Executive Committee shall have the power to fill any vacancies occurring in its number or in any office. The Executive Committee, acting with the President and Vice-President, shall receive and act upon the written report of the Committee on Admissions on charges preferred against any member.

SEC. 3 The Committee on Admissions shall consist of seven (7) members appointed by the President, who shall also name the chairman. As provided in Article III, Section 5, it shall consider all names proposed for membership, and shall elect only those candidates who in its judgment are qualified for admission to the Society. When any candidate is not elected, the committee shall notify the member by whom he was proposed of this fact. Appeal from action by the Committee on Admissions may be taken to the Society by obtaining the written concurrence of one-fourth of the Active members addressed to the President. The Committee on Admissions shall also, as provided in Article III, Section 6, investigate charges preferred against members of the Society and report upon them to the President, Vice-President, and Executive Committee.

SEC. 4. The Committee on Meetings shall consist of three members appointed by the President, who shall also name the chairman. It shall select the speakers, subjects, and dates for meetings of the Society, as provided in Article VI, Sections 2, 3, and 4.

SEC. 5. The Editorial Board shall be appointed by the President, and shall consist of nine (9) members. Within this Board there shall be appointed an executive committee, one member of which shall be designated by the President as Editor-in-Chief. The Board shall decide on the regular policy of the publication. The executive committee shall consider papers read before the Society, or otherwise submitted to it, shall approve or reject them for publication, and shall transact the business necessary to that end.

ARTICLE VI

MEETINGS

SECTION 1. The Society shall hold an annual meeting, executive meetings, and open meetings.

SEC. 2. The annual meeting shall be held at a place and on a date to be designated jointly by the Executive Committee and the Committee on Meetings. It shall be for the transaction of business and for the presentation and discussion of professional papers.

SEC. 3. Executive meetings shall be open to members only, and shall be held at the call of the President or, in his absence, at that of the Secretary. They shall be for the transaction of business and the discussion of any subject selected by the Committee on Meetings.

SEC. 4. Open meetings may be attended by members and by guests of the Society, and shall be held as directed by the Committee on Meetings. The Society may hold such field meetings as the Society or Committee on Meetings may direct.

SEC. 5. A quorum shall consist of seven (7) Active members.

SEC. 6. Upon the order of either the Executive Committee or a majority of the Active members present at any meeting, any question shall be submitted to the membership for decision by letter-ballot.

ARTICLE VII

AFFILIATED ORGANIZATIONS

SECTION 1. Any local forestry society or club whose membership includes two or more Active members of The Society of American Foresters may petition the Society in writing, through such members, for the enrollment of the society or club as an affiliated organization. If, in the judgment of the Executive Committee, the membership and aims of the organization are of sufficiently high professional character, the committee shall grant said petition and the organization be enrolled as the ....., affiliated with The Society
(Name of organization.)
of American Foresters.

SEC. 2. Affiliated organizations shall determine the qualifications for membership in them, but no rights or privileges belonging to Active members of The Society of American Foresters shall be attained merely by membership in an affiliated organization.

SEC. 3. As a condition of affiliation with the Society, each affiliated organization shall, as a whole, pay the regular annual dues of $3, and shall receive one copy of all publications and communications of a public nature intended for Active members. The organization shall also elect one or more of the Active members of the Society in good standing, who shall represent the Society officially and shall handle all business and correspondence between the Society and the affiliated organization.

SEC. 4. Papers delivered before any affiliated organization shall be the property of that organization and may be published in its official organ. The affiliated organization may offer for publication in the Proceedings of The Society of American Foresters papers of a high professional or technical nature which have not already been published. These papers shall be subject to the approval of the Editorial Board, and if not approved for publication shall be returned to the organization in which they originated.

SEC. 5. The Executive Committee shall have the right at any time to rescind the authorization for any affiliated organization and to terminate its connection with the Society.

ARTICLE VIII

SECTIONS

SECTION 1. To carry out more effectively the aims of the Society, Sections may be established wherever there are enough Active members to form a strong local organization. The formation of such Sections may be authorized by the Executive Committee upon the written petition of ten or more Active members. Only Active members of the Society shall be eligible to membership in a Section. A Section shall be known as the .....Section of The Society
(Name of place.)
of American Foresters.

SEC. 2. The officers of each Section shall consist of a chairman and a secretary and such others as may be found necessary.

SEC. 3. Any Section may, subject to the approval of the Executive Committee, adopt for its own government such by-laws as it may find expedient, provided that no part thereof shall conflict with the Constitution of the Society.

SEC. 4. No money from the general funds of the Society shall be appropriated or used for the expenses of a Section.

SEC. 5. Papers and discussions presented before any Section shall be the property of the Society, and the secretary of the Section shall forward a copy to the Editorial Board. The Editorial Board shall have full right to publish in the Proceedings of the Society such papers as it may approve for publication. Papers and discussions not approved for publication by the Editorial Board shall be returned to the Section in which they originated.

SEC. 6. The Executive Committee shall have the right at any time to rescind the authorization of any Section and to terminate its existence.

ARTICLE IX

PUBLICATION

SECTION 1. The Society shall publish such papers read before or contributed to it, and in such form as the Editorial Board shall approve.

SEC. 2. The publications shall be free of charge to all members of the Society.

ARTICLE X

DUES

SECTION 1. The annual dues of Active members shall be $3 and of Associate members $2. Dues shall be payable in advance upon the first day of January, except that the dues of newly elected members for the year in which they are elected shall be payable from the date of their election.

SEC. 2. Honorary members shall pay no dues.

SEC. 3. Any member whose dues are more than three (3) months in arrears shall be notified by the Treasurer. Should his dues not be paid when they become six (6) months in arrears, he shall lose the right to vote or to receive the publications of the Society until the obligation is discharged. Should his dues become nine (9) months in arrears, he shall again be notified by the Treasurer, and if such dues become one (1) year in arrears he shall forfeit his connection with the Society. The Executive Committee, however, may, for cause deemed by it sufficient, extend the time for payment and for the application of these penalties.

ARTICLE XI

AMENDMENTS

This Constitution may be amended by letter-ballot by a three-fourths (¾) vote of the members voting, provided the proposed amendments have been submitted to all Active members at least four (4) weeks in advance.

Proceedings
of the
Society of American Foresters

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Vol. XI APRIL 1916 No. 2

CONTENTS

Suggestions as to Possibilities of Silviculture in America ..... B. E. Fernow 171
Utilization of Wood Waste by Chemical Means ..... Howard F. Weiss 177
Top Diameters as Affecting the Frustum Form Factor for Longleaf Pine ..... Herman H. Chapman 185
Water Requirements and Growth of Young Cypress ..... Wilbur R. Mattoon 192
The Woodlot: Its Present Problems and Probable Future Status in the United States ..... C. R. Tillotson 198
A Forest Census of Alabama by Geographical Divisions ..... Roland M. Harper 208
Professional Ethics ..... Theodore S. Woolsey, Jr. 215
The Factor of Top Diameters in Construction and Application of Volume Tables Based on Log Lengths ..... Herman H. Chapman 221
The Biltmore Stick and the Point of Diameter Measurements ..... Donald Bruce 226
What is a Forester? ..... Frederick E. Olmsted 230
The English Names of Some Trees ..... W. W. Ashe 233
Scientific Notes and Comments:
- Importance of Source of Seed in Forestation ..... Nils B. Eckbo 240
- Heavy Damage from January Storms in Southwest ..... C. W. McKibbin 244
- Checking Check Scalers ..... Theodore S. Woolsey, Jr. 245
- Effect of Roadside Trees ..... G. A. Pearson 248

Reviews:
- Forest Valuation ..... Herman H. Chapman 250
- Finland's State Forests ..... S. T. Dana 254
- Forest Pathology in Forest Regulation ..... A. B. Recknagel 258

Society Affairs:
- The Proposed Membership Changes and the Ends which They Will Accomplish ..... C. L. Hill 264
- Official Symbol of the Society 269
- Dr. Charles Albert Davis—Necrology 270

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The Proceedings of the Society of American Foresters appears quarterly—in January, April, July, and October. It contains papers delivered before the Society at its regular meetings, and original contributions by both members and non-members of the Society.

Papers that have already appeared elsewhere will not be accepted for publication. Simultaneous publication in another journal will not be agreed to.

Manuscripts may be sent to any member of the Editorial Board and should be clearly typewritten and in suitable form for printing without essential changes. Footnote references should be complete, including year of publication.

The Editors reserve the privilege of returning to the author for revision approved manuscripts and illustrations which are not in proper finished form for the printer, or, if the author so desires, the Editors will have the manuscripts and drawings prepared and charge the author the cost of this work.

Illustrations will be used only when absolutely necessary and will be confined largely to text figures or diagrams of simple character. The Editors, at their discretion, may call upon an author to defray the cost of his illustrations.

Since the membership of the Society is scattered throughout the United States and the nature of the field work of its members takes them often to remote and inaccessible places, in order to secure prompt publication no proof will be sent to authors unless requested. They are urged, therefore, to submit their manuscripts in final form and the Editors will exercise care in seeing that copy is followed.

The author receives only one free copy of the number containing his contribution. Reprints, however, can be secured at cost.

As an author may not see proof, his request for reprints should reach the Editors before his paper goes to press and should preferably be attached to the first page of his manuscript.

Missing numbers will be replaced without charge, provided claim is made within thirty days after date of the following issue.

Proceedings
of the
Society of American Foresters

Vol. XI APRIL 1916 No. 2

SUGGESTIONS AS TO POSSIBILITIES OF SILVICULTURE IN AMERICA

By B. E. Fernow

Dean, Forest School, University of Toronto

Delivered before the Society January 22, 1916

Silviculture, the production of wood crops, is the pivot of the whole forestry business.

To argue this proposition would be equivalent to arguing that a brickyard's function is to make brick or a farmer's business to produce food crops.

The fact that nature unaided has provided wood crops without human aid tends to cloud the claim that the forester's business is to produce wood crops; his real function is apt to be overlooked because he can begin harvesting without having sowed. Nevertheless, I claim, if he does so, if he harvests, without at least an attempt to replace the harvested crop or to secure a better one, he does not deserve his title. He becomes merely an administrator of timber lands and a logger. He may fulfill *these* functions more efficiently and more conservatively than his predecessors, but he fails to fulfill his main function, which is propagation of the forest, and not only propagation, but *skillful* propagation—improvement on nature.

In taking this position, in denying the title of forester to a timberland administrator or logger who does not make continuity of forest cropping his main concern, I do not mean to imply that their functions are not also needful ones, and under circumstances for the time being perhaps the only ones that can practically be executed.

Circumstances may prevent them from practicing silviculture, the art of forest crop production; but, then, they are not practicing forestry in its full sense. The very title of the subject, which I have been asked to discuss, suggests that it may be impossible to practice silviculture in this country.

There are only three or four possible reasons which may exclude silvicultural practice in this country, namely, those inherent in nature, those inherent in economic conditions, and these include financial ones, and, lastly, the ignorance of foresters how to proceed; or else there might be various combinations of these reasons.

Nobody will maintain that nature sets a bar to the practice of silviculture except at the timber limits, and even these can be overcome by the skill of man; the plantings of forestless sand hills and arid territory with or without irrigation attest to this superiority of man over nature. Such untoward natural conditions may only set limits to the application of silvicultural *methods* which would lead to success.

Whether, for instance, natural regeneration would be applicable to the dry soils and dry atmosphere of the West, or to the undergrowth-pestered, mismanaged woods of the East, or whether under these conditions artificial reforestation promises better success may well be a question.

As far as nature is concerned, we can practice silviculture in this country as in any other, albeit the methods must be adapted to the difference of climate and soil and species.

Economic, and especially financial, consideration may, however, justifiably exclude not the possibility, but the propriety, of employing silviculture in timber-land administration.

As long as virgin supplies in plenty can be brought to market on which no cost of production need be charged, it would look questionable whether it is financially possible to practice silviculture, to expend energy and money on starting new crops which it takes such a long time to mature. Moreover, as long as the fire danger is what it is, another factor inimical to the application of silviculture exists which properly deters the timber-land administrator from increasing the risk of loss. Here we must begin to classify timber-land owners, for financial aspects have a different meaning to the small owner, the large owner of several classes, and the government.

The farmer with his woodlot, who can protect it readily, who can work his lot inexpensively, can very well practice silviculture, reproducing his crop, except that the smallness of his lot and its isolated position introduces some limitations as to the methods applicable.

The small timber-land owner is somewhat in the same position.

But whether a large owner can find satisfaction in a business which is so slow, promising returns only in a distant future, and which is beset by unusual risks, will depend upon special conditions of that owner. If, as in the case of paper companies, the very large investment in the mills makes it desirable to insure continuity of wood supplies, a special inducement to practice silviculture exists.

Finally, however, the financial test, as in all business, will have to be applied, and even if the government be the owner, financial considerations cannot be entirely ignored.

Now, it is a very sad fact that finance calculations in forestry are of a very speculative nature for the simple reason that they deal with long time; that they require the forecasting of the future—forestry, indeed, deals in futures.

No matter whether the harvested crop is replanted or secured by natural regeneration, whether an improvement felling or a thinning is made, or any other silvicultural work is undertaken, the operation necessitates an expenditure or the foregoing of a present revenue for the sake of a future return, and that return comes only in decades, if not a century or more. It involves a knowledge of future market conditions, not only of material demands and material production, but of future money values and reasonable interest charges. The long time which is mostly involved in securing returns from such an investment as is required in silviculture, besides the speculative character of the forest finance calculations, is a strong reason for private enterprise not to engage in this business.

There are, however, two fallacies into which those who apply the financial test are apt to and have fallen, to be guarded against, the avoidance of which places a much more favorable face on the situation.

Many who have figured on the financial aspect take it for granted that there is only one way of figuring, namely, to require a compound interest calculation, somewhat similar to the requirement of the soil rent theory. This, to be sure, is the only correct way if we are dealing with a newly made plantation or with a limited single stand, which permits only of an intermittent business, a present harvest, and another a hundred years hence. But if we deal with a whole forest which is capable of furnishing an annual or frequent return the compound interest calculation is entirely erroneous or at least irrational. Here the annual revenue is merely to return interest on the additional investment which is represented in the silvicultural operation, and the problem is merely whether in the end this relatively small curtailment of the revenue will be compensated by later increased or longer continued returns. In other words, in a forest giving annual returns the calculations of the forest rent theory are alone rational.

The other fallacy is to apply present prices and current interest rates to figure returns in the distant future.

This is done with an idea that thereby the calculation will be safe. This is the same kind of safety by which the expert, leaving out of consideration favorable points, loses for his client a bonanza.

If there is anything more certain in this world of doubt and surprises than that wood values will rise still for a considerable time to come, I would like to know it. Experience and arguments are all in support of this proposition; the only question is, How fast and to what height will they rise? How fast stumpage values will rise depends, to be sure, on a complication of circumstances; but, by and large, the rise may proceed in proportion as the knowledge of the decrease of virgin supplies grows.

As to the height of their rise, I think we are safe in assuming that they will exceed highest present European prices.

For the present these European prices are still depressed by the importations from exploiting countries. As is well known, in these as well as in the importing countries, wood prices have risen steadily and increasingly so, especially in the last 20 years. In Germany this rise during that time was around 20 per cent.

When will these prices or similar ones be reached by us here? Surely, before the end of our virgin supplies has become certain, and that will be within the period for which the cost of any present silvicultural operation may be submitted to financial test.

I would assert that in this country at large, in locations where nearly all wood assortments are salable, a price of 10 cents per cubic foot on the average will not appear extravagant, and for log timber alone double that figure, or, say, $25 per M feet in the log, will soon be a safe average price.

As with all manufactured goods, finally the cost of production with a fair profit must rule market prices. This must come when logs are actually produced and not secured merely as gifts of nature.

Similarly with interest rates. The current interest rates for money must, of course, be paid for money capital actually borrowed; but he who invests his own money in a long-run investment like the forestry business cannot expect a compounding at present money rates.

Realizing the unquestionable rise of wood prices and the propriety of a low interest rate for compounding, the financial results of plantations will look not so uninviting to any one who can figure for a somewhat distant future.

Lastly, we are entitled to expect a repetition of the experience of the European nations who have engaged in this business, as our economic and populational conditions approach theirs. When, therefore, we learn that

France during the last century by private and government enterprise reforested 2,400,000 acres of waste lands at an expenditure of $18,000,000, and finds herself in consequence in possession of a property valued at $140,000,000, we are justified in calculating on similar results from similar expenditures.

The government at least, which has a providential function to fulfill and whose finances are based on the long run, can have no excuse whatsoever of a financial character for not applying silviculture, and that of a high grade, on its properties, just as I consider a management for the eventual sustained yield the only justifiable one for a government, and this is possible only by the application of silviculture.

In this connection I may quote from an article by Professor Kirkland, which touches incidentally a phase of silviculture as possible even financially from present points of view. He says: "In parts of the Pacific Northwest profitable thinnings can be made today in stands 40 years old, where within short distance to transportation, and in the Idaho white-pine region yields from thinnings will be of far more volume than final cuttings on the bulk of the Rocky Mountain forest areas."

The only remaining excuse for not applying silviculture on National Forests immediately can, then, only be ignorance of how to do it.

This statement is in no way intended to be a reflection on the ability of the present administration. It is really a bona fide good reason.

There is such a thing as "honorable points of ignorance;" and where could a more honorable point of ignorance be found than in a field which can produce knowledge only by experience, when the time for the accumulation of experience has been lacking?

We will have to confess, we teachers of silviculture, that the knowledge we propound is of a most general character, which fails to suffice when it comes to applying it in a given specific case. Silviculture is still an empirical art, relying upon trial and experiment to find out a modus operandi. We must realize that all we can learn of silviculture as practiced abroad is principles, and then not always firmly based.

With a hundred years of experience behind them, with only a very limited number of species to propagate, with only limited territory, and that means limited climatic conditions, the practitioners of Europe are still at variance on almost any silvicultural practice. Opinions and judgments, not specific prescriptions, rule to a large extent. If this is so, even in the fatherland of forestry, what shall we expect as regards application under vastly different and vastly varying climatic conditions, with an entirely different set of species, and a large number of them to deal with, and without experience?

Ignorance becomes excusable under such conditions, and it is justifiable to hesitate before applying untried methods on a large scale.

It is my belief that at present all energies ought to be bent on making silvicultural studies, on securing by field work and experiment the biological and ecological knowledge which should underlie silvicultural practice.

I suppose the Forest Service Experiment Stations are doing this.

I would, however, accentuate that only the best men—best as to knowledge, imagination, and judgment—can be expected to secure trustworthy results. Indeed, specialists who are thoroughly competent to apply modern methods of ecological research are needed for this work.

Beware of doctrinaires is my parting advice! They have kept silviculture back for a century, even in Germany.

UTILIZATION OF WOOD WASTE BY CHEMICAL MEANS

By Howard F. Weiss

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Delivered before the Society, November 18, 1915

INTRODUCTION

I hope the subject assigned to me will interest you, because you are undoubtedly interested in the welfare of the lumber industry, which is now quite sick. One cause of the "sickness" is an overdose of production of one product—lumber. Lumbermen may be likened to George Washington Ezekiel Scraggs, who on entering the kingdom of heaven was furnished a harp. George knew but one tune, and after he had played this for thirty years reposing on a cloud bank, he got so all-fired sick of his tune and his harp that he gave his instrument away, although it was a very good instrument. Many lumbermen are now so all-fired sick of making lumber that they want to give their sawmills not away—but to the Government. I will attempt to show you that a little diversity in products would not only add interest and zest to this sick industry, but to its profitableness as well.

We will review in this paper what is now being done in the United States in the utilization of wood waste by chemical means, or, in other words, producing from wood products other than wood. You will appreciate, of course, that it is entirely beyond the scope of this paper to enter into a review of this kind in any great detail. My remarks will deal only in round figures. I will attempt to give you, first, a very brief description of those chemical processes now established in the United States which utilize wood waste; second, the extent to which they are now commercially established; and, third, their future outlook for expansion.

The leading chemical methods for the utilization of wood waste now established in the United States are:

1. Production of pulp and paper.
2. Destructive distillation of hardwoods.
3. Destructive distillation of softwoods.
4. Extraction of softwoods.
5. Extraction of tannins.
6. Manufacture of ethyl alcohol.
7. Manufacture of gas.

In addition there are a number of processes of minor importance doing their part to reduce the waste of our forests. The more important of these are the extraction of essential oils, the extraction of potash, the extraction of dyes, and the production of oxalic acid.

PRODUCTION OF PULP AND PAPER

Slabs and edgings and tree-tops normally left in the woods are forms of waste adapted for the manufacture of pulp and paper by either the groundwood, soda, sulphite, or sulphate processes. The species, the waste of which is now chiefly used, are the pines, spruces, hemlock, firs, cottonwood, chestnut, poplar, and tulip. The technique of these processes is so well known to you that I will not dwell upon it here.

Of the 200 pulp and paper mills in the United States, 35 are now utilizing lumber waste. These 200 plants consume annually about 4½ million cords of wood, of which 338,000 cords, or 7 per cent, are waste. The utilization of waste by pulp mills has been steadily on the increase; five years ago the consumption was but 248,000 cords.

The future for waste utilization of sawmills by pulp mills is exceedingly bright. Improvements are constantly being made in methods of producing pulp and handling mill waste which are not only decreasing the cost of pulp, but improving its quality. The useful articles which can be manufactured from pulp made from wood waste are almost unlimited, and this form of utilization presents a virgin field for exploitation in this country. We have received at the laboratory samples of furniture, cord, rope, rugs, clothing, sausage cases, onion sacks, barrels, pails, etc., made from pulp, all of which can be produced from sawmill waste and which indicate the possibilities of this method of utilization. A striking example of the field for future development along this line which I will call to your attention is the attempt now under way to substitute wood paper for sisal in the manufacture of binder twine. One concern in the United States alone produces 125,000 tons of binder twine annually, all of which is made from sisal and Manila fiber, which, as you know, grow outside the United States. If a twine from paper made from our own sawmill waste can be substituted for this imported fiber, it will keep 12 fair-sized pulp mills running at full capacity and will utilize all of the slabs and edgings in the production of three-quarters of a billion feet of lumber, or the entire waste in slabs and edgings of five good-sized sawmills.

DESTRUCTIVE DISTILLATION OF HARDWOODS

Although beech, birch, and maple are the chief woods used in the destructive distillation of hardwoods, other woods, particularly the oaks, hickories, eucalyptus, tanbark oak of California, and possibly red gum, are especially suited for this process, the leading products of which are charcoal, acetate of lime, and wood alcohol. Slabs, tree-tops, and limbs are the chief forms of waste used. The three common methods of destructively distilling hardwoods are known as the oven, retort, and kiln methods. In both the retort and oven methods the wood is piled in closed iron retorts or ovens in cord-wood form and then heated to high temperatures without a free access of air. This decomposes the wood into gases, which upon condensation yield a pyroligneous liquor, the refining of which gives acetic acid and wood alcohol, the charcoal remaining in the oven when it is removed and allowed to cool slowly in iron coolers.

There are now 87 plants destructively distilling hardwoods in the United States. Of these, 58 now use wood waste. Of the 1,240,000 cords of wood used by these 87 plants, 510,000, or 41 per cent, is waste in the form of slabs or tops.

The normal growth in the demand for products from the destructive distillation industry would accommodate the output of approximately two new plants per year. The products of this industry are of such value in our modern industrial life that there is little likelihood but what the destructive distillation of hardwoods has become permanently established and will constantly expand. One instance, perhaps, will illustrate to you my reason for this statement. Wood alcohol is absolutely essential in the production of formaldehyde. Experiments by agricultural stations have shown that seeds of cereals, particularly of wheat and oats, when dipped into formaldehyde before planting are not affected by the disastrous smuts, so that the yields from fields planted with dipped seeds are very materially increased. Furthermore, dangers from fire and explosions in threshing the harvest are greatly reduced. The treatment of seeds by this method is now rapidly becoming standard throughout the grain-growing areas of the United States.

I cannot dismiss a discussion of this industry without alluding to the very valuable discovery made by Robert C. Palmer, of the Forest Products Laboratory. Palmer has developed a method for increasing the yields in the destructive distillation of hardwoods about 15 per cent without adding to the operating expense. This is done by an exact control of the temperatures in the retort primarily before the exothermic reaction begins.

DESTRUCTIVE DISTILLATION OF SOFTWOODS

Longleaf pine and, to a very limited extent, Norway pine and Douglas fir are the woods used in the destructive distillation of softwoods, the main products being turpentine, charcoal, and tar. Waste in the form of slabs, stumps, and light wood are used in this process. The methods for destructively distilling softwoods are not unlike those for hardwoods. One process uses superheated steam in place of direct heat to drive off the products, while another first heats the wood in a bath of hot pitch, thus driving off the turpentine, after which the wood is destructively distilled. The retort is the common form of apparatus used in the distillation of softwoods. There are now 30 plants in the United States, all of which use waste. Their total consumption of wood is 162,000 cords per year.

While this industry has not been as flourishing as the destructive distillation of hardwoods and seems to have reached a maximum, it is felt that a further study of the products which can be refined from the tar will cause it to expand appreciably.

EXTRACTION OF SOFTWOODS

Longleaf and Norway pines are the chief woods used in the extraction process which requires the wood shall be very finely shredded before it can be used. It is then placed into large retorts and steamed to drive off the turpentine, after which the chips are given several baths with a light petroleum distillate which dissolves out the rosin contained in them. A distillation of this distillate separates the rosin from the petroleum solvent, which is used over again, while the rosin is run into barrels and shipped. Stumps, light wood, slabs, and rosin dross are the chief forms of waste used in this process.

There are now seven plants in the United States, and all of them use waste to the extent of approximately 125,000 cords per year.

Due primarily to the depression now prevailing in the naval stores industry and to certain other causes, extraction plants are not in a prosperous condition. But as the market becomes more stabilized and the value of turpentine and rosin increases, such as is bound to occur, this industry will develop at a rapid rate. By far the great bulk of the world's supply of turpentine and rosin comes from the United States, and thus far, in spite of a reward for $50,000 offered by the German government several years ago, no substitute for rosin has been found. You may be interested to know that some excellent sheets of strong wrapping paper,

far superior to any heretofore seen by me, have been made by the Forest Products Laboratory from the chips in the extraction process after turpentine and rosin had been taken from them.

EXTRACTION OF TANNINS

Hemlock and oak barks and chestnut wood furnish our main domestic supply of vegetable tannin in this country. The bark and wood are shredded and then leached in diffusion batteries with warm water which dissolves out the tannins. When extracts are made, the leached liquor is then passed through a series of multiple-effect evaporators and evaporated to the proper consistency. In tanneries the bark is leached direct except in those which use the extract above mentioned.

There are now 592 consumers of tannin in the United States who use annually 625,000 cords of hemlock bark, 290,000 cords of oak bark, and 380,000 cords of chestnut.

The importation of quebracho extract into the United States, due largely to the indifference of lumbermen who produce hemlock bark, as well as the rapid strides made in the tanning of leather with chrome tannins, have very seriously curtailed the demand for the vegetable tannins produced from our forests, and the future offers but little promise of their increased consumption unless the cost of bark can be reduced. The Forest Products Laboratory has been working in co-operation with a number of manufacturers of drying machines and with leather chemists in developing a method of producing tan bark, which, if successful, will reduce the cost of this product to about one-half its present price. The process consists in mechanically peeling the logs, artificially drying the bark, and then baling it for shipment. This enables the barking operations to be done at the sawmill the year round, and overcomes entirely the expense of extra bark camps and crews and a great deal of handling. The results thus far with this new method have been extremely gratifying.

MANUFACTURE OF ETHYL ALCOHOL

Coniferous timber is best suited for the production of ethyl alcohol. Mill waste in the form of sawdust or "hog feed" is used. This is run into digesters, where it is steamed in the presence of a small amount of acid. This treatment produces sugars, which are subsequently leached from the wood in diffusion batteries, after which the extracted liquor is neutralized and seeded with yeasts. These act upon the fermentable sugars and convert them into the ethyl alcohol of commerce.

While four plants have been built in this country to operate on this process, only one is now being successfully managed, the other three having failed because of technical defects and unfortunate promotion.

There is little doubt but what this process offers a most excellent outlet for large quantities of sawmill waste, since ethyl alcohol is a product used extensively in the arts, and its use is constantly increasing. We feel that it can be produced from sawmill waste at a cost of 15 cents a gallon, and that at this figure it will compete successfully with the ethyl alcohol produced from molasses, grain, and potatoes. Recent researches by the Forest Products Laboratory and the Du Pont Powder Company have materially improved the yields of alcohol obtained from wood. I feel that the Pacific Northwest, with its enormous stands of coniferous timber, furnishes an excellent region for the establishment of alcohol plants, and that its development out there is but a matter of a few years.

MANUFACTURE OF GAS

All forms of wood waste after they have been passed through a "hog" are adapted for use in the manufacture of gas. This gas is made by heating the wood without a free access of air, a treatment which decomposes the wood primarily into carbon monoxide. The gas is then washed and stored in a manner similar to the production of coal gas. It is now used in this country for two main purposes: (1) To run gas-engines for the production of power, and (2) as an illuminant like ordinary "city gas." There are now four plants in operation in the United States making producer gas and one plant making illuminating gas, which use annually about 30,000 cords of wood waste.

As the cost for fuel and power increases, it is likely that the operation of producer gas plants will become more common, since they are extremely efficient. For example, 2½ pounds of dry wood in a producer gas plant will develop one brake h. p. hour, whereas it takes from five to eight pounds of wood to develop the same amount of power in a steam-engine. You may be interested to know that the city of Auburn, Washington, now secures all of its gas from wood waste manufactured in bench retorts. The gas is piped through the city in the same manner that coal gas is now so commonly used.

MINOR CHEMICAL PROCESSES FOR UTILIZING WOOD WASTE

About 15,000 cords of waste are now used in the production of essential oils from spruce and cedar in a number of small plants scattered throughout the country. We consume annually about 60,000 pounds of

spruce oil and 200,000 pounds of cedar oil in the manufacture of soaps, shoe blackening, etc.

The elimination of Germany's deposits of potash from the world's market has caused much interest of late in methods for manufacturing potash in this country. There are a number of small plants now in operation extracting potash from hardwood ashes which right now are securing a handsome profit. It is quite likely, however, that as soon as the German deposits are again available to the world's market these plants will go out of business or be seriously crippled.

A similar interest has been aroused in the production of dyes, since Germany controls the dye production of the world. Tests conducted at the Forest Products Laboratory have conclusively demonstrated that our osage oranges produce a dye with properties as good or better than that obtained from fustic, now imported in large quantities from Mexico. We are in constant touch with a number of dye-makers, who are now testing this wood in carload quantities, and I hope its use for this purpose will become firmly established.

So far as I know, there is but one plant in the United States manufacturing oxalic acid, 8,000 pounds of which are produced daily. Since this industry has been established, our American manufacturer has had great difficulty in competing with foreign producers of oxalic acid and may not be able to hang on to the "toe hold" he now has.

Taking all factors into consideration, the advance in the chemical utilization of forest waste in the United States is very gratifying, although the quantity of waste material used is still exceedingly small. If we assume that our country produces annually about 46,000,000 cords of waste, all of the chemical processes combined use only about 4.6 per cent of this output. But we now have over 390 plants successfully using wood waste, and their number is constantly increasing.

The importance of finding practical methods for utilizing the waste of lumber operations is, of course, thoroughly appreciated by all wide-awake foresters. It seems to me quite unlikely that lumber prices can advance very materially over what they were in 1907, because there are so many other building materials now manufactured at costs only slightly above that of lumber that the prospective builder is given a wide choice in selecting his materials. This condition did not exist 10 years ago. For example, the cost of building an average-size dwelling in the New England territory is now only 10 per cent more when built with brick than when built with wood, and when insurance, upkeep, depreciation, etc., are taken into consideration this initial advantage is entirely overcome in a few years. Furthermore, these building materials are being manu-

factured at decreasing unit costs. On the other hand, lumbermen are faced with increasing costs of stumpage and manufacture. It seems to me, therefore, that if the lumber industry is to remain a profitable one, the lumberman must not only manufacture and merchandise his lumber more efficiently, but must find methods of utilizing more of his raw material than he is now doing. He is confronted with no bigger problem than were manufacturers in other lines who have found methods for using their waste materials. When methods for waste utilization are developed, they will enable lumbermen to cut down their cost of producing lumber, since all operating and investment charges need not be levied against this one product—lumber—as at present.

Lumbermen, as a rule, do not figure that it costs money to destroy their mill waste; but if they should take into consideration the cost of their burner, together with its upkeep, interest, etc., they will find that it costs them from 15 to 25 cents per thousand feet b. m. simply to destroy their mill waste. If, now, this waste instead of going to a burner could be manufactured into some salable product, like pulp or alcohol, it would convert this operating charge of 15 to 25 cents a thousand into a revenue producer.

I know of one large yellow-pine mill in the South which has very thoroughly gone into this matter of utilizing its waste, and now wipes off $1.54 per thousand from its cost of producing lumber, due to the profits secured from its waste, while other mills similarly situated and operating in exactly the same character of timber are still complaining of their losses.

Another gratifying change, which is slowly but surely taking place, is a closer co-operation between sawmills and by-product mills using waste. If this development continues, it will do wonders to stabilize the lumber industry and introduce the fundamentals of forest management, now so sadly neglected.

TOP DIAMETERS AS AFFECTING THE FRUSTUM FORM FACTOR FOR LONGLEAF PINE

By Herman H. Chapman

Professor of Forest Management, Yale Forest School

In a previous article it has been shown that top diameters of used length for certain species increase with d. b. h. and diminish with increase in merchantable height. Western yellow pine and longleaf pine are characteristic species to which this rule applies.

The application of the principle of a frustum form factor, by which the contents of trees is compared with that of cones having equal top diameters and scaled as if divided into 16-foot logs, depends in practice upon the determination of the proper top diameters to use for these frustum volumes. When a species is actually cut to a uniform top—say, 8 inches—regardless of the d. b. h. or number of logs per tree, this diameter becomes the basis for the frustums and determines the volumes for this basic table. If two or more species are cut uniformly to the same top diameter, the same basic table applies to each, and the frustum form factors, which are the actual volumes of the trees divided by volumes of the frustums, indicates differences in the form and volume of the species. Donald Bruce has shown how such a basic table can be used for several species by computing the specific form factors.[1]

But this discussion does not bring out the absolute dependence, not only of the volumes in the basic table, but of the form factors themselves, upon the uniform top diameter assumed. Following the plan as outlined by Bruce, C. F. Korstian prepared frustum form factors for western yellow pine in the Southwest[2] on the basis of a uniform average top diameter, determined for 1,000 trees, of 10.2 inches, rounded off to 10 inches.

If the top diameter of the actual tree is larger than that of the frustum, the resulting form factor from this source alone will tend to be greater than 1, increasing in proportion to the discrepancy in volume caused by this difference in diameters. The reverse is true of form factors for trees with top diameters less than those chosen for the frustums. Since the law of variation of top diameters for this species is an increase with d. b. h. and a decrease with height, we would not have to compute the

[1] Proceedings, Vol. X. No. 3, p. 315.
[2] Proceedings, Vol. X. No. 3, p. 301.

form factors to know that these would also vary by the same law, and without any reference to the shape of the tree. This result was obtained by Korstian and shown by curves (page 308).

A similar calculation for the purpose of demonstration was recently made by the writer with 555 longleaf pine analyses taken in Coosa County, Alabama. The weighted average top diameter was here found to be 13.2 inches and this was used for the frustum volumes.

The resulting form factors, not evened off by curves, are shown in Table 1 and clearly indicate the trend of values.

TABLE 1.—*Frustum form factors for 555 longleaf pines, Coosa County, Alabama, based on average top diameter of 13.2 inches for frustums*

D. B. H.	16-foot logs.					
	2	2½	3	3½	4	4½
14	.53	.53	.54	....	....	....
15	.57	.59	.50	.55	....	....
16	.71	....	.51	.56	.53	.57
17	.67	.76	.65	.69	.60	....
18	.88	.55	.72	.74	.77	.69
19	1.03	.81	.84	.81	.78	....
20	1.13	1.00	.87	.96	.87	.86
21	1.31	....	.98	....	.85	.79
22	....	1.39	1.00	.99	1.01	.88
23	1.54	1.39	1.19	.98	1.09	....
24	1.40	1.40	1.13	1.26	....	....
25	....	1.37	1.34	1.33	1.06	....
26	2.60	.95	1.85	1.21	1.47	.97
27	1.97	....	1.52	1.22	1.23	1.14
28	....	....	....	1.26	.97	1.27
29	....	....	1.67	1.35	....	....
30	....	....	1.98	1.37	1.17	....
31	2.36	1.04	1.18	.68	1.51	....
32	....	....	1.76	....	1.43	....

It is evidently impossible to apply such form factors to other species. It is equally clear that any variation from the top diameter of the frustum in actual logging practice destroys the "standard" quality of the form factor. By means of carefully calculated form factors varying with each diameter and log length, the discrepancy between the factors and the true tree volumes is bridged; but it is questionable whether such form factors have the merit of reliability and simplicity sought.

This variation in contents caused by the range of top diameters must be overcome somewhere in the process of constructing a volume table. As shown in the previous article, the table *must* give the volumes of trees

of the top diameters actually utilized in order to be safely applied in estimating. If the method of form factors is used, instead of the direct construction of a volume table, there is no merit whatever in adopting a uniform top diameter for the frustums which acts mechanically to distort the form factors.

The only other possible plan is to ascertain the actual average top diameter for each d. b. h. and height class and construct the basic table of frustum volumes on this basis. If the actual top diameter of each tree is also used for the frustum, the resulting form factor represents the *true relation* between the form of the tree and that of the frustum.

The same data used in checking Korstian's form factors were now worked up by this method. As a preliminary step, the average volume of all trees in a given diameter and height class and their average top diameter was computed. The frustum of a cone of the same top diameter to 1/10 inch was then measured in 16-foot logs and the true form factor calculated. Both trees and frustums were measured at equal 16-foot intervals up to an even log or half-log length, and not to odd lengths. The results are shown in Table 2, on page 188.

While considerable variation in the form factors of separate classes is shown, corresponding to similar variations in volumes for individual trees, yet the average, weighted by numbers, on basis of height, falls between 0.939 and 0.966, a range of but 0.027; and when based on diameter, if we except the 34-inch trees, there is a total range of from 0.902 to 1.000 or 0.098. The average of all trees weighted by numbers is 0.9468, or approximately 0.95, and since no distinct tendency is shown to vary by either diameter of height, this might be adopted for the region and species tested. Further tests would show whether it could be applied throughout the range of the species.

To prepare a volume table on this basis, the eccentric frustum volumes used in calculating this "true" form factor, varying to correspond with variable actual average top diameter, should give place to a table of volumes of frustums prepared from "curved" tables of average top diameters, in which the average top increases regularly with d. b. h. and decreases with increased height, following the trend revealed by the actual tops. The frustums computed from these tops give the basis for frustum volumes, 0.95 of which gives the actual average volumes of the trees. Had this process of curving the average top diameters been applied previous to the calculation of the frustum form factors, there would have been greater variation in these factors, due to comparing an "average" topped frustum in many instances with an actual average tree volume having a larger or smaller top. As long as the average tops are correctly

TABLE 2.—*True frustum form factors for longleaf pine, from frustums whose top diameters coincide exactly with the average top diameter of trees of each d. b. h. and height class. Basis trees shown for each class in upper right-hand corner.*

	2	2½	3	3½	4	4½	Average by diameter.	
12	19 0.98	2 0.98	.....	.....	.....	.....	21	.980
13	35 .97	4 1.21	7 0.99	.....	.....	.....	46	.992
14	29 .96	9 .87	11 .97	4 1.03	.....	.....	53	.952
15	27 .90	9 1.01	13 1.03	2 1.05	.....	.....	51	.958
16	16 .92	.....	15 .94	7 1.04	2 0.94	1 1.10	41	.953
17	10 .89	11 .95	13 .91	6 .99	3 .99	.....	43	.932
18	11 .89	9 .98	13 .90	12 .96	1 1.13	2 1.00	48	.934
19	5 .96	6 .90	13 .94	14 .98	4 .99	.....	42	.954
20	1 1.05	4 .95	8 .88	7 .97	4 .94	1 .99	25	.937
21	4 .90	.....	14 .88	.....	6 .94	4 .92	28	.902
22	.....	1 .92	9 .89	16 .94	7 .96	5 .99	38	.938
23	3 .93	4 .97	9 .94	9 .88	2 1.00	2 .91	29	.926
24	2 .93	3 .94	5 .87	6 .95	.....	.....	16	.921
25	.....	3 .96	1 .94	3 .98	6 1.04	.....	13	1.000
26	1 .94	.....	.....	5 .90	2 1.07	3 .90	11	.934
27	3 .93	.....	1 .96	3 .95	3 .93	2 .95	12	.941
28	.....	.....	.....	2 .93	2 .80	2 1.01	6	.913
29	.....	.....	2 1.01	2 .93	.....	.....	4	.970
30	.....	.....	2 .98	1 .85	3 .96	.....	6	.948
31	1 .94	1 .80	1 .84	.....	1 1.13	.....	4	.927
32	.....	.....	.94	.....	1 .89	.....		.915
33	.....	.....	.....	.....	.....	.....	.....	
34	.....	1 .92	.....	1 .85	2 .80	.....		.817
Averaged by height....	167 .939	67 .961	138 .932	100 .958	49 .966	22 .962	Weighted average.	.9468

determined for the frustum volumes, this method gives the most accurate results. It is obvious that the "true" form factor cannot be applied to frustum volumes which make no pretense of conforming to actual tree-top diameters. The error in so doing is correctly shown by the table of form factors which actually do apply in such cases (Table 1).

To apply the "true" frustum form factor for any species or locality, one must first ascertain by field measurements the actual average top diameters to which the trees are cut, correlating these with d. b. h. and height in the field, and later by means of curves. Then the table of frustum volumes can be computed, using these tops, and from this, by application of the form factor, the true average tree volumes found.

TABLE 3.—*Board-foot contents of longleaf pine, Doyle Rule, Coosa County, Alabama, from frustum volumes based on variable top diameters and a uniform form factor of 0.95.*

D. B. H.	16-foot logs.					
	2	2½	3	3½	4	4½
12	75	90	100	.....	.....	.....
13	85	105	120	.....	.....	.....
14	100	125	145	.....	.....	.....
15	115	145	170	185	.....	.....
16	135	175	200	220	235	.....
17	160	205	240	265	290	305
18	190	245	280	310	335	360
19	220	280	325	360	390	415
20	255	325	375	415	455	485
21	300	375	430	480	525	560
22	345	430	500	555	600	635
23	405	500	570	630	680	725
24	460	565	650	720	770	815
25	525	635	735	810	870	925
26	600	725	830	910	975	1,035
27	680	810	925	1,015	1,090	1,145
28	765	910	1,030	1,125	1,205	1,265
29	860	1,015	1,140	1,240	1,320	1,390
30	955	1,115	1,255	1,370	1,460	1,530
31	.....	.....	1,370	1,495	1,590	1,670

It is to be noted that the values in this table do not increase uniformly with increased height, but tend to a convex curve.

The data shown are an insufficient basis for concluding that the form factor 0.95 will apply to longleaf pine in other regions. Very close utilization of limby tops with rapid taper will tend to produce form factors greater than 1. But given uniform market and logging requirements, any variations in form on soils of different qualities or for trees

of different ages may be largely eliminated by the preparation of a *new basic table of frustum volumes* for the locality and using the actual average top diameters determined there. The form factors, if computed on the above basis, will probably vary within very narrow limits and permit of the construction of volume tables largely in the office, and at considerable reduction in cost.

The measurement and averaging of top diameters, based on d. b. h. and log lengths, is more expensive than the mere determination of the average top, independent of both other factors; but in other respects the claim that time is saved and accuracy increased in volume-table construction by employing form factors as a means seems to be borne out by the investigations so far conducted. The computation of the frustum volumes occupied one man seven hours, including determination of tapers by plotting. Form factor table took three hours and the volume table one hour.

Due principally to the variable top diameter utilized by loggers, the plan of a *universal table* of frustum volumes for all species, with separate specific form factors, cannot be applied to species or regions where this variable top factor is operative; nor would such a universal table recognize difference in average taper per log for different regions, except when this difference means a different number of logs per tree. The plan advocated by Dr. Alvin Schenck of constructing frustum volumes for different log lengths with different tapers—say, 1, 2, 3, and 4 inches—for each diameter class introduces this element of elasticity and enables the cruiser to select volumes to coincide with his idea of the average taper per 16-foot log. Similar tables—applied to all species—are in use on the Pacific coast and can be computed by any one in a short time. But they are inaccurate through failure to admit that there is any form factor other than unity—that is, that the tree volume may not agree with that of the frustum—and that they assume arbitrary tapers of 1, 2, and 3 inches per log, while the actual average difference between top and bottom diameters usually falls at an arbitrary figure between these tapers. Both these points are correctly determined by the frustum form factor method.

Yet so valuable is the possession and use of a single standard table in estimating that the above frustum volumes of Schenck and even rule of thumb methods are quite generally used by woodsmen and cruisers in place of the elusive and expensive, but accurate, local volume table for separate species.

The writer makes this suggestion: Tables of standard frustum volumes could be prepared, based on d. b. h., assuming that d. i. b. stump = d. b. h. for purposes of the volumes sought. These standard tables should show

volumes for frustums for each d. b. h. and 16-foot log length, and for each standard average taper by half-inch (or even quarter-inch) classes, for the standard log rule used in that vicinity. For example:

D. B. H.	Log length.	Tapers, Standard (beginning at 1″).					
20″	4	1″	1¼″	1½″	1¾″	2″	etc.
Total volume (Doyle Rule)		734	671	612	556	504	

For accurate application of this basic table to a given species, the *average taper per log* would be determined by measuring and comparing the merchantable top diameters with the d. b. h., or even by measuring a large number of logs, or using a dendrometer on standing trees. After selecting the volumes coinciding with this taper, a correction factor or frustum form factor would be applied. (In present practice this correction is ignored by most cruisers.) If, for instance, investigation based on the above principles of determining the "true" frustum form factor should show that 0.95 is consistent for longleaf pine, or that 0.9 could be relied upon for certain hardwood species, the local volume table is obtained, first, by selecting from the above standard table the volumes corresponding with the average taper to one-fourth inch, and then deducting 5 per cent, or 10 per cent, as above, for the form factor. Where trees differ in form, in degree of utilization, and in standard of board-foot measure applied to their contents, there never can be a universal volume table which can be applied without modification to different species. The above plan may come as near to it as practice requires.

WATER REQUIREMENTS AND GROWTH OF YOUNG CYPRESS

By Wilbur R. Mattoon, M. F.,

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A field study of southern cypress (*Taxodium distichum* Rich.), which included the amount and character of natural reproduction as an essential part, resulted in evidence regarding the moisture requirements of the tree that points strongly toward the following conclusions:

In the early stages both the seed and seedlings of cypress demand a very high degree of soil moisture, so that in its juvenile stages the species seems to be semi-aquatic in habit.

Subsequently the moisture requirements diminish quite rapidly, and throughout the remainder of the life of the tree growth is most vigorous in a deep, loose, well-drained, rich, sandy, or clayey loam, well supplied with soil moisture, humus, and available mineral food. Thus the requirements of cypress after the juvenile period seems to be very similar to those of the broadleaf trees. The very slow growth of cypress in extremely wet localities bears out this view, namely, that the trees are tolerating conditions unfavorable to their best development.

Only the first of these conclusions, or early life period, will be considered in this discussion.

The well-known close confinement of cypress to swamps has been a problem upon which different explanatory views have been expressed. The subsidence of the coastal region, for example, is one of these. A broad generic explanation offered by some is that cypress, because of its inability to compete with species better adapted to occupy the more favorable uplands, has been forced to these admittedly unfavorable situations.

Observation shows very definitely that, with possibly rare exceptions, cypress seed fails to germinate successfully in nature on well-drained soils or other seed-bed, even though permanent water is close by. The conclusion of the writer—tentative at least—is that this exacting requirement in early life for moisture in large amounts furnishes the key to the whole question of cypress distribution. The best conditions for germination appear to be a seed-bed of sphagnum moss or muck, very slightly, if any, above a constant water level. Aëration, however, is necessary, for it has been experimentally found that the seed will not germinate when submerged in water. These characteristics, it seems likely, account for cypress being the dominant tree in the forests of the permanent swamp

lands of the South and for its advance ahead of all other trees as river and sea marshes are gradually built up.

Experimental Test of Water Requirements

In this connection a few tests made with cypress seed and seedlings will be of interest for the light which they throw on the subject in support of the correctness of the observations and conclusions stated above.

1. The effect of different degrees of water upon early seedling growth during a period of six weeks are graphically shown in figure 1. Four

FIG. 1.—*Effect of water supply upon early development of cypress seedlings*
From photographs taken at the close of the experiment

pots, each containing two two-weeks-old cypress seedlings, were treated differently in respect to watering, as follows:

(*a*) Water surface was kept about one inch above the soil surface; cotyledons beneath water and stem and secondary foliage above.

(*b*) Water level maintained at about that of the soil; complete saturation and very little aëration of soil.

(*c*) Water supplied to the soil from beneath, pot standing in water about one inch deep. (Water shown considerably too deep in figure 1.)

(*d*) Water supplied by daily applications directly at the soil surface; thus the amount of available soil moisture varied quite widely, especially since high temperatures, accompanied by low relative humidity, prevailed during middays.

The increase in height growth during the period is shown in Table 1. With the soil completely filled with ground or hydrostatic water (*b*), the maximum increase in growth of 5.2 inches, or 473 per cent, took place.

TABLE 1.—*Effect of water supply upon early height growth of cypress seedlings*

Quantity and character of water supply.	Soil aëration.	Height of dominant seedlings at different ages.[1] Age in weeks. 2	4	6	8	Total increase in height in 6 weeks.	
		In.	*In.*	*In.*	*In.*	*In.*	*P. ct.*
(*a*) Soil surface submerged about 1 inch below water level.	Very poor.	1.7	1.8	2.2	Died[2]	...	...
(*b*) Complete saturation of soil—water kept at level of soil.	Surface only.	1.1	3.7	5.2	6.3	5.2	473
(*c*) Abundant — pot standing in water about 1 inch deep.	Good.....	1.5	3.7	5.0	6.1	4.6	306
(*d*) Varying supply—soil watered daily from top.	Complete..	1.3	3.0	3.4	3.6	2.3	177

[1] First measured on May 26 at age of two weeks, and last on July 6, 1914, at age of eight weeks from germination.
[2] Seedlings died during the sixth week.

A constant supply of liquid water in the bottom of the receptacle (*c*), affording the plant a complete supply of capillary water, resulted in a good growth of 4.6 inches, or 306 per cent. The submerged seedlings (*a*) died in five weeks, and those subject to widely varying moisture supply (*d*) showed a poor development, of only 2.3 inches, most of which was made during the first three weeks. This test, although insufficiently comprehensive to furnish conclusive evidence, indicates a water-soaked soil as the most favorable moisture condition for rapid development.

2. Cypress seed have a thick, hard outer seedcoat and require softening for a considerable period before germination can take place. Failure to meet the requirements of continuous and abundant moisture undoubtedly explains the experience of many in the past of securing only very unsatisfactory cypress germination, amounting with some to a belief that cypress seed cannot be made to germinate under ordinary methods of nursery practice.

Some cypress seeds, after being kept in unchanged water indoors for a period of six weeks, were sown during the hot weather of July in sand flats. The result was 65 per cent germination, complete in 14 days. This is a high per cent of germination for cypress. A similar soaking test was

made in stagnant water in a warm office-room, continued for four months, beginning May 27. The seeds were then sown in greenhouse flats of sand, with a result of 29.4 per cent germination in five weeks.[3] Probably the large amount of antiseptic resin contained in the seedcoats accounts for the preservation of the seed for long periods in stagnant water during hot weather. In another test cypress seed was kept supplied with an abundance of air and moisture for 61 days in a Julius Steiner belljar germinator and then sown in warm weather. Only one seed germinated in the jar,[4] while germination was completed with a result of 78 per cent in nine days after the seed were removed and sown in sand flats.[5]

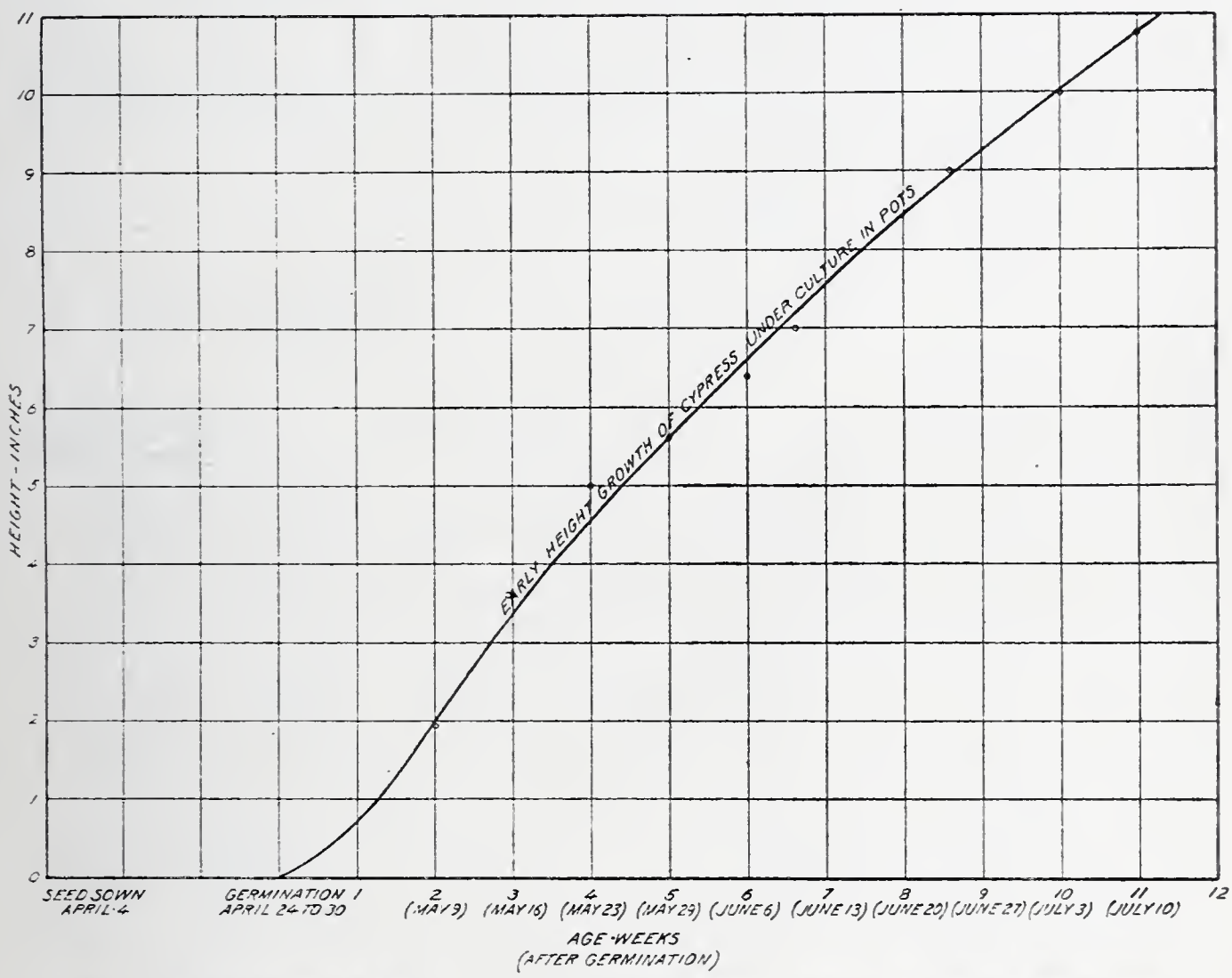

FIG. 2.—*Very rapid height growth of young cypress under intensive cultivation*

The economic application of these results leads to the recommendation in nursery practice of soaking the seeds for a period of several weeks preparatory to sowing. The duration of this period has not been definitely worked out experimentally, but appears to be from four to eight weeks. By this method a great reduction in cost is effected over the usual

[3] Thirty-nine out of 100 seeds used were thin, scalelike, abortive seeds. This made a 55 per cent germination of the seeds of normal mature size and shape.

[4] A germination of 58.6 per cent was secured with three-year-old shortleaf pine seed (*Pinus echinata*) in the Steiner jar—a very good showing indeed.

[5] The seed used was selected and above the average in quality.

method of frequent waterings in nursery beds, continued for a period of from one to three months.

Vigor of Seedling Growth

The seedling from the time it emerges from the seedcoats shows unusual vigor and rapidity of growth. In early life, if removed from water for considerable time beyond the wilting stage, cypress seedlings rapidly recover when replaced in water or wet soil. This is in striking contrast to most conifers, such as the pines and spruces. The capacity for rapid growth is illustrated by the following examples:

1. Some cypress seedlings in a window box of an ordinary office-room grew uniformly during the first 11 weeks at the rate of about 1 inch in height per week. When 5 weeks' old they averaged 5.6 inches and at 10 weeks just 10 inches. The measurements given below are illustrated further in figure 2:

Date.	Age of seedlings.	Height.
	Weeks.	*Inches.*
April 3	.....	(Seed sown)
30	.....	(Germination)
May 2	1	1.2
9	2	2.0
16	3	3.6
23	4	5.0
June 1	5	5.6
6	6	6.4
9	6½	7.0
24	8½	9.0
July 3	10	10.0
10	11	10.8

2. Some cypress seedlings growing in earthen pots under the same office conditions as described above reached heights at the close of the season of about 18 inches. On June 15 of the second season the height was 23.5 inches and at the close of the season 29 inches. The range during the first season was from 10 to 18 inches, averaging perhaps 14 inches. This undoubtedly is not the maximum growth which it might be possible to secure by growing seedlings in a greenhouse.

Natural seedlings in the Southern States commonly reach heights of 8 to 10 inches during the first season and 16 to 20 inches the second season (figure 3). This characteristic of rapid height growth in early life may have been specifically developed by the tree in its effort to successfully meet the unfavorable conditions of periods of high water. If

so, it is an interesting case of adaption to local surroundings. In the Green Swamp, near Wilmington, North Carolina, four-year-old root-collar stump sprouts were found measuring up to 12 feet high and 3 inches in diameter breast high. The parent stumps were of trees mostly

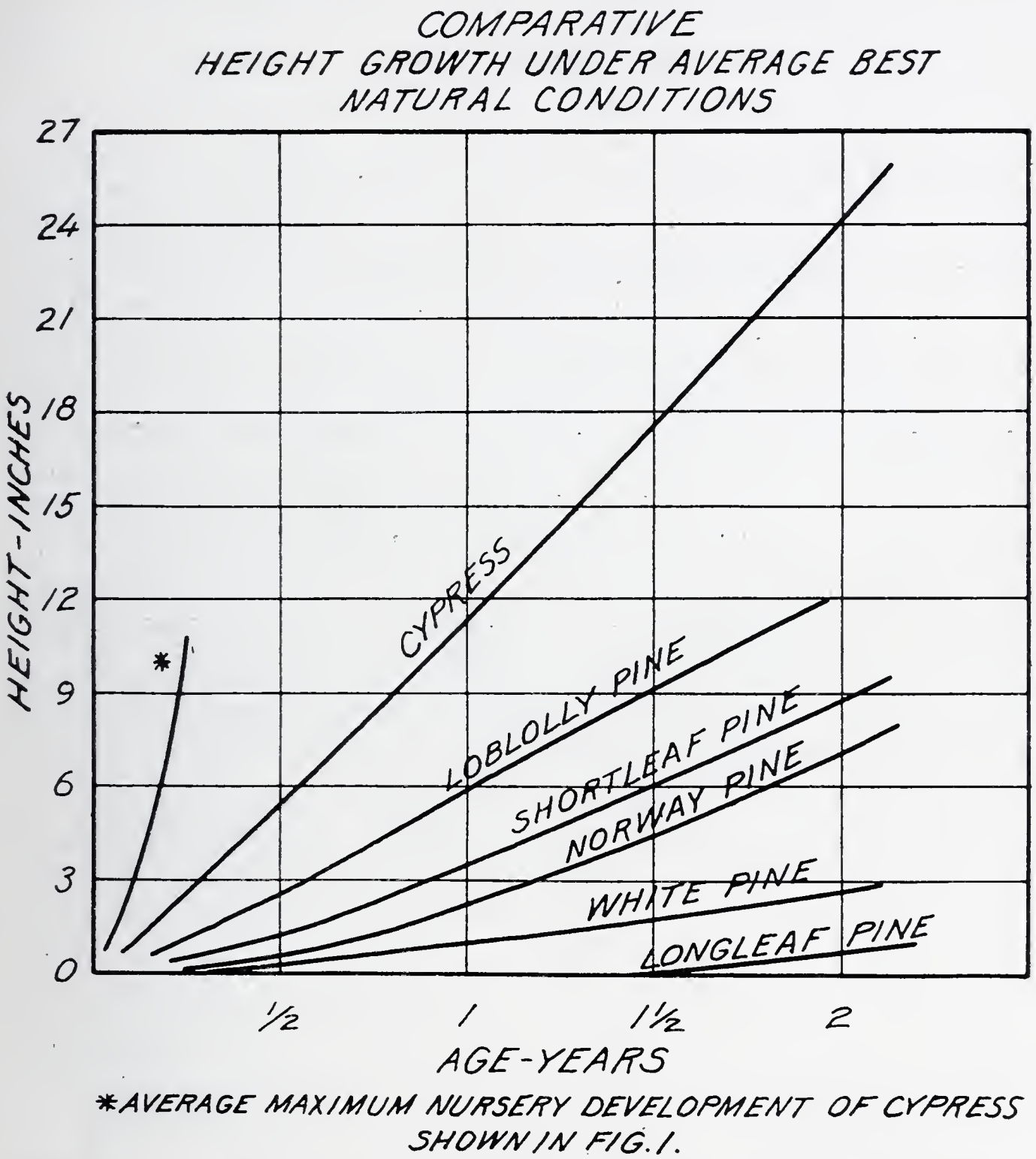

FIG. 3.—*Comparative height growth of several important eastern conifers*

40 to 75 years old, but in one instance 180 years. In the Grand River basin, Louisiana, sprouts from the top of stumps 4 feet high in nine years grew 35 feet in height by 7 inches in diameter, measured at 4½ feet above the top of the stump. It seems doubtful if an equal capacity for rapid height growth in early life, either naturally or under intensive cultivation, is possessed by any other North American conifer.

THE WOODLOT: ITS PRESENT PROBLEMS AND PROBABLE FUTURE STATUS IN THE UNITED STATES

By C. R. Tillotson

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There has been a great deal said and written about the woodlot situation in the United States. We all realize that the situation is not to our liking, yet when attempting to wrestle with its problems, it develops so many aspects that it is both confusing and difficult of solution. There is, in my opinion, no one single woodlot problem, but several arising from at least three distinct situations in this country. In the northern portion of the Lake States and in parts of the Southern States, where the cleared land is as yet only a small portion of the farm, the problem in the main is quite different from that in the older-settled Central States, where most of the land is already cleared and under cultivation. In the prairie region the woodlot is not, as a rule, the remnant of the original forest, but has been planted by the farmer either for wind-break purposes or for the production of domestic supplies of fuel, posts, etc. Here is another distinct situation which demands a different treatment. In each of these three regions the main problems are radically different and their solution must also be different.

The large timber output of the farm woodlots, valued by the 1910 census at $195,000,000, has, I am afraid, led some people to attribute to the farm woodlot too great an economic importance as a source of a future timber supply of the country. The United States agriculturally is still in the pioneer stage. Large stretches of land, partly forested, have been taken up for agricultural purposes, and a great deal of clearing is still going on both in the North and in the South. The large timber output from the so-called farm woodlots comes particularly from this source. It cannot, therefore, be considered as the sustained product of the permanent woodlot. When most of the agricultural land now under timber has been taken up, the supply of timber from this source must inevitably greatly decrease. In such regions the marketing of woodlot products is in many cases far more important than the marketing of the farm products. As the problems of this particular type of region have in another paper been so ably presented by Mr. MacKaye, I shall confine myself to those which exist in the prairie and in the older settled formerly timbered

agricultural region of the Central States, and to a forecast of the probable future status of the farm woodlot in the United States.

In the prairie region the problems are fairly simple. They consist largely in teaching the farmer how and what to plant for his simple farm needs and how to care for the young timber during its first few years of growth. Often it will be a case of planting for post or fuel production; but just as frequently it will be a matter of planting for protection of buildings, feeding yards, and crops against winds. This latter is usually the first type of planting in such regions, while the former is a later development. Advice in regard to these points requires some judgment upon the part of foresters, but, thanks to the work of experiment stations in various States and studies of the regions where planting has been carried on, the main problems can be said to be fairly well solved. In handling it our care must be not to let our zeal run away with our judgment, but to put the planting proposition squarely upon its own merits and not exaggerate its importance or possibilities. The problem can generally be satisfactorily handled by correspondence and the distribution of literature, although aid on the ground will often be desirable.

In the better-developed central hardwood region the situation is more complex in that there is a diversity of problems. The one taking first rank will depend upon the viewpoint. To the forester or any student of silviculture the most important of these is the silvicultural one. Viewed from this angle alone, the woodlot situation is nothing if not depressing. Silviculturally the condition of these natural woodlots is very generally in a deplorable state. Little care is being given the present crop and less provision is being made for a future one in spite of much agitation of the subject. It is well to note what are the contributing factors to this condition in order that they can be dealt with as may seem fit.

Foremost among these is the character of land which the woodlots occupy, taken in connection with the returns received from the timber crop. In many cases timber is considered to be occupying ground which is more suitable for agricultural crops, and there are good, sound reasons for this contention. Foresters are, I believe, perfectly willing to face and acknowledge the fact that timber production for profit cannot compete with the growing of field crops on agricultural land having a value of about $30 or more per acre. There is also as yet some room for question as to whether land of even lower value is not better adapted to some form of general farming—pasture, for instance—than it is to timber production. Investigations now under way by the United States Department of Agriculture will eventually clear up the point of the value of these lands for general farming purposes, and it is the task of foresters to show its possi-

bilities for timber production. This will be attended by more difficulties than are apparent at first glance. Forestry has not progressed far enough in this country to enable foresters to state facts in regard to some phases of the subject. We cannot, for instance, accurately foretell yield for many of the species on different sites found in farm woodlots. This, of course, is fundamental in figuring returns. Foresters, moreover, are under the disadvantage of not being able to forecast stumpage prices. While all feel certain that these will advance considerably, an element of doubt enters into any calculation of future returns, which is bound to chill the ardor even of enthusiastic forestry supporters, let alone a mildly interested farmer.

The United States Department of Agriculture is today devoting itself very actively to the subject of farm management. This will eventually mean, in part, that farm land will be put to the use for which it is best fitted. While this may possibly result in the continuation of some and the inclusion of other types of land in timber, even under private ownership, it assuredly will result in the clearing of much land now occupied by woodlots and its devotion to the growing of field crops. In the settlement of much of the central hardwood region in particular, the first portion of the homestead to be put into agricultural crops was the higher lands. When cleared of timber these areas could be cultivated because their natural drainage was good. This was not true of the lower ground. Even when cleared it was likely to remain too wet for successful cultivation because of seepage from the surrounding forest-covered land on higher ground. In consequence the condition today is that in many cases the remaining woodlots are found on the very best soil of the farm. They will in the natural course of events be cleared and the area devoted to agricultural crops. A diminution in the area of natural woodlots in this section and in any other where such a condition exists can be expected. Foresters will abet rather than discourage any such changes in the use of the land, for solely as a crop proposition the growing of timber as a private enterprise must stand on its own feet without bracing by the props of sentiment, public welfare, etc.

Another factor which has been conducive to neglect of the woodlot is that it is a heritage which is not appreciated and will not be until it has passed or is about to do so. This is such a general rule that those in the lumber business in the woodlot region look forward expectantly to the death of some of the old pioneers who largely for sentimental reasons are withholding from sale a choice bit of timber. Upon their death it is almost a foregone conclusion that the heirs will dispose of the timber, and the woodlot which remains will be abused and soon assume the same

general uncared-for appearance of its neighbors. This is true not only of natural woodlots, but also of the planted ones in the plains region. The sons are not giving much attention to the stands planted by their fathers and found so necessary by them, particularly in the rôle of protective belts.

There is another condition which undoubtedly has contributed to the present state of woodlots, and that is the tenant system of farming. To what extent this has been a factor it is impossible to say, but it has probably been of less influence in the past than it will be in the future. The disposition of tenants to take as much out of a farm and put as little in it as possible is well known to all. It is easy to see, therefore, that they would be less particular about the damage which their stock did to the owner's woodlot; in choosing material from it for farm use they would be extremely likely to pick the very best, and a fire in the lot would also not be considered a serious matter to them. In this connection it is interesting to point out that over one-third of the farms of the United States are operated by tenants, and there has been an increase of more than 300,000 in their numbers since 1900.

Pasturing has contributed very largely to the present condition of the woodlots. Unpastured woodlots are rare. While lamented by foresters for silvicultural regions, it may in reality be the best economic practice not only from the standpoint of the farmer, but from a general one as well. Practically all farmers agree that shade is essential in raising live stock, either hogs or cattle. Its exact value is not appraised by them: but if beef stock puts on only one or two pounds more per year and milch cows yield several quarts more of milk, it can readily be seen that shade has the value which is commonly attributed to it. A study covering this point would undoubtedly yield interesting data. The forage value of woodlots may not be great, but the lot iself serves as a runway, where a larger amount of stock can be maintained, which will later feed on the rough stuff produced on other lands of the farm. If not running in the woodlot, this stock would be occupying other land and prevent its utilization for the growth of field crops.

From the farmer's viewpoint in this region, the problem, if he considers there is one, is the marketing of his products, although, because his tillable land area is large and his woodlot small, it is not at all a vital one. In fact, any problem connected with the woodlot is more or less a side issue with him. The returns from the sale of woodlot products are likely to be low. This is in spite of the fact that many of the woodlots, probably the greater proportion of them, are situated in regions where a good market for the material can be found. Some woodlot owners are

very keenly alive to the values of timber, and unless pressed for money can generally be depended upon to exact full toll for whatever is purchased from them. Unfortunately for their own good, many others do not know these values and become easy victims of such timber buyers as may wish to take advantage of their ignorance. To the timber buyer this bargaining is merely a matter of business, and he is scarcely open to more criticism than a man in any other line of business who buys to the best advantage possible.

I think it may be said that in general owners of woodlots are at a disadvantage in selling their timber for several reasons. The markets other than the local ones are unknown to them. They have no readily available means of learning current market values either of lumber or logs, and they are utterly unfamiliar with methods of estimating the amount and quality of timber on their woodlots. If these things were known to them, there would be little doubt but that the deserving ones at least would receive full value for all wood products removed from their farms. Those failing to do so would scarcely be deserving of sympathy.

To solve these two problems of silviculture and marketing is the task faced by those interested in the woodlot and its owner. It can be attempted in two ways. Since help in marketing will interest the average farmer far more than that in silviculture, it is probable that this former phase should be given the greater emphasis. By the distribution of printed matter covering these subjects some impress could be made, but there are limitations to this method of imparting information which are difficult to overcome. The location of markets could well be covered in this manner, but the market values of products would be more effectively brought to the attention of the farmers if printed in farm papers once in two or three months. More frequent quotations would not be required, as the necessity of marketing timber crops within very definite limits of time is not so pronounced as in the case of many agricultural crops. Through publication in such papers the material would come into the hands of many more farmers than through publication in other form. The securing of these data is a matter which enterprising farm papers should take up for themselves, and which they would probably do if a demand were created for it. Prices at only a few of the more important marketing centers would need be quoted.

Methods of estimating the quantity and quality of timber and the silvicultural practice to be followed can best be pointed out by personal demonstrations. Silvicultural problems will be numerous and will demand distinct methods of treatment for individual cases. Estimating is work which will be attended by considerable difficulty until the man engaged

in it is quite familiar with the local character of the timber where he works and the classification which different industries follow in grading logs. To illustrate these two points: It is known by all interested in timber that a certain species will run perfectly sound in one region or situation, while in other even contiguous regions or situations it may run badly defective without giving much indication that such is the case. An estimate of the logs by quality classes in standing trees is in such instances likely to be sadly amiss, yet quality should be known in order to market advantageously. Sawmill men and veneer plants usually recognize two or three grades of logs based on quality and pay different prices for each grade. Thus a No. 1 white-oak log 18 inches in diameter may be worth $30 per thousand feet to them, while for a No. 3 or cull log of the same dimensions they will pay only $16 per thousand feet. It is evident that it is decidedly to the advantage of the seller of logs to know what qualifications or defects throw a log into one class or another. Inquiries of buyers usually elicit the response that they must see the log before they can tell into which class it will go. Undoubtedly his own classification is clear in the mind of each individual buyer, but any two of them are likely to disagree. This lack of standardization of log grades is something which makes the estimating of standing timber or the scaling of logs a very difficult matter for the seller when he wishes to take quality into consideration. To be successful a man will have to be quite familiar with the requirements of the different industries which furnish the market.

Because these woodlots for a number of years to come will continue to supply timber of a virgin quality for the general market, it is to the owner's interest to become informed on this subject, or at least be able to go to sources where he can obtain the information. The problem is a local one and can accordingly best be handled by local men. A number of the States have State foresters who will undoubtedly be available part of the time to give the aid needed. This is only one of the problems which a State forester has to meet, however, and the time which he could devote to it would by no means be commensurate with its needs. Other men are needed. Fortunately, it appears that through the corps of men which the Extension Service of the United States Department of Agriculture and the State Agricultural colleges are adding to their staff, the essentials in the matter both of silviculture and of marketing woodlot products can be brought home to the farmer. At present, however, most of these men know little about these subjects, and before they can become effective workers they must be given considerable help and instruction. The field is so broad that it is beyond the power of the Federal Forest

Service to carry this help to all of them, and it is to be hoped therefore that each State will make provision to do this itself. Under the terms of the Smith-Lever bill, I understand that there is nothing which prohibits the employment by the State Agricultural College of an expert in forestry who will devote himself to extension work in that line the same as experts in agronomy, animal husbandry, etc., are employed to carry on their particular lines of work in conjunction with the county agents. Such a man would be free of many of the obligations confronting State foresters; he would soon become thoroughly familiar with State conditions, and he would be in an excellent position to get at the heart of the woodlot problems, both marketing and silvicultural.

In counties where there are no county agents I have not the slightest doubt but that the forester of the State Extension Service could work out with some local man or men an effective scheme whereby farmers wishing aid in marketing could obtain it. There are men in nearly every community who, while not actively engaged in the logging or lumbering business, are familiar enough with it to be of great aid to any woodlot owner contemplating a sale. Some of these men may have logged in the past, but have quit the business for some other line of work, or they may simply be farmers of more than ordinary business ability who have sold considerable timber from their own lands. Arrangements could undoubtedly be made and given publicity through local farmers' organizations whereby these men would be subject to the call of others in their community who desired their services. They would probably exact payment for their labors, but the expenditure of ten dollars for the gain of one hundred or even fifty would be money judiciously spent.

Summing up the prairie and central hardwood region woodlot problems, the former is found to be chiefly one of planting for protection and fuel and farm timber production. This problem can be successfully met by correspondence and the distribution of literature, although the personal help of a forester on the ground would at times be desirable. In the central hardwood region the problem is to the forester a silvicultural one and to the woodlot owner the marketing of the products. These two problems can be partly handled by the distribution of literature and the publication of market quotations in farm papers; but the whole situation—silvicultural, marketing, and any other economic feature which may enter in—can be most effectively met by the presence in each State as a part of the State Extension Service of a forester who would work through the county agents in aiding the farmer in the same manner as experts in other lines.

It is difficult to foretell what rôle the farm woodlot will play in the future development of this nation. As previously intimated, however, I do not feel much hesitancy in predicting that as a source of timber for the general market it will be of negligible importance. Several factors will lead to this end. The growing of timber on the long rotations necessary to produce sizes valuable on the general market is not an enterprise for men of small capital. The average farmer is such a man. His capital is represented largely by land, which must yield him an income each year in order that he may live. His perspective, accordingly, is very much limited to the present day. He is not deeply interested in the welfare of future generations or of returns which he might secure fifty or more years hence from an investment at the present time. It is doubtful, therefore, if the subject of timber production for profit, if truthfully presented, can ever be made attractive to him, even if it were demonstrable that the returns at the end of fifty years or more would be even greater per year on the average than could have been obtained from other crops in the interim. To most farmers this matter of deferred returns is probably the biggest drawback to the growing of timber. In this connection, also, we can not lose sight of the fact that some classes of poor farm land will not produce timber of most rapid growth. It is better suited to the production of the more slowly growing species, such as the white oaks and hickories—very valuable species, it is true, but requiring 100 years or more to reach merchantable sizes.

Aside from this, timber production has the element of risk from fires, storms, insects, fungi, etc., in connection with it, which is not to his liking. Further, at any period during the rotation the timber will not sell on the market for a price proportionate to its final one. This will operate against his receiving proper value for it in case of sale of his farm. If, for instance, the rotation were two-thirds complete, he could not receive two-thirds of the timber's final value. The element of risk and changes in ownership may then be listed as other potent causes which will operate against the production of new crops of timber of high commercial value in farm woodlots.

The silvicultural limitations in farm woodlots will further tend to this end. The present remaining stands of high-class timber found in some woodlots are not criterions of what can be produced in the future on small areas of ten to forty acres. It must be remembered that the high-class timber existing in and being cut from woodlots today is the product of forest conditions existing over vast areas—conditions, in fact, which are quite essential to the production of such material. Small areas do not lend themselves to the establishment of good forest conditions. The

forest floor becomes dried out, the tops are more severely damaged by storms, and the trees along the edges are certain to be of poor form. Because of fewer trees natural reproduction will not come in so rapidly after cutting, and in making sales concessions which are silviculturally disadvantageous would ordinarily have to be made to lumbermen because of the limited amount of timber. Pasturing will also always be a detriment to the best silviculture.

Summing up, then, deferred returns, risk, changes in ownership, and silvicultural limitations will operate against the production on farm woodlots of high-class timber for the general market. The place of the farm woodlot in this respect will be taken by communal, county, and State forests. This is, I believe, inevitable. Rough and poor sandy lands now in farms will become so unproductive that they will revert to the State through non-payment of taxes. The issue will then be thrust upon the States by the natural sequence of events—a force which they will be unable to combat. State forests, as all present know, have been established in a number of States and there is agitation for others; county forests are being advocated in some regions, and communal forests are already in their incipiency. On such forests there will not be the limitations in management which are unavoidable in farm woodlots. Foresters welcome this trend and all should get behind and push it, for it is from such forests, as well as those of the Federal government, that our future high-class supplies will be drawn.

Although farm woodlots will furnish little of such material for the general market, it does not follow that the woodlot will entirely disappear or will not perform an important function in the life of the nation. On the contrary, it is believed that it will perform a very important part. Timber will always be useful for farm repairs, although, with the passing of rail fences, the substitution of cement posts for wooden ones, the manufacture of implements entirely of steel, and the use of cement or brick for buildings, the need for it will not be so great as in the past. The use of wood on the farm for fuel is now at a rather low ebb, because it happens that portions at least of the woodlot region coincide with the coal and natural-gas fields. These fuels are so cheap that they are burned in preference to wood. This condition cannot continue indefinitely, and these fuels, particularly gas, have already played out in restricted localities. Both, moreover, are bound to increase in price. The production of fuel for home use may, then, in the future become expedient upon the farm, and its desirability for this purpose will be given impetus by periods of fuel famine, such as have occurred in the past. Coupled with this and probably nearly as conducive to the same result will be a growing

realization of the value of woodlots or protective belts of timber for wind-breaks. In the treeless regions the old settlers realized this and planted wind-breaks around their buildings and in many cases around their fields. The present generation has been rather busy cutting them down; but it is interesting to note that already the next step in the natural progress of events is taking place. The groves which have been cut down are being replaced by other species, largely conifers, which occupy less of the valuable ground, but are better suited for the purpose of wind-breaks. Further, in the regions where natural timber was formerly abundant, but now cleared, we find planting of timber for wind-break purposes going on. Eventually a stable condition in this matter will undoubtedly be reached and trees planted, or woodlots reserved by one generation will be retained by the next.

Since the necessity of shade for stock exists, this will, I believe, be a factor which will serve to retain natural woodlots on the farms which have them and induce planting on those which do not. Without them artificial shade will need to be provided, which would probably be less acceptable and more expensive to establish and maintain.

There is still one other feature which should be touched upon. The efforts of agricultural colleges and others working for the benefit of the farmer are not directed solely toward increased production and such features as relate to the business management of the farm. They are concerned, also, with the social betterment of the farmer and a general uplift in the conditions of his home life. The woodlot cannot very well be left out of any plans having this in view, for it fits in too well with the purpose of the scheme. The nation is becoming more and more interested in this feature of its progress. When a man passes the commercial period of youth he begins to think more and more of some of the other aspects of life which make it worth living, but are not dominated by the dollar sign. He begins to have an appetite, which increases with age, for the æsthetic and restful features. What is true of men is more or less so with nations, and it is not too much to expect that eventually this United States will be a nation on whose farms the taste for the beautiful will be partly reflected in the woodlots and shelterbelts.

Our future type of woodlot, then, will probably be of two classes, and both may be found on the same farm: (1) The sprout hardwood type, managed on short rotation, which will furnish fuel and such rough sticks as are needed for farm purposes, and will also provide shade for stock; and (2) the coniferous protective belt type, whose principal purpose will be the protection of buildings, feed yards, and possibly crops.

A FOREST CENSUS OF ALABAMA BY GEOGRAPHICAL DIVISIONS

By Dr. Roland M. Harper, College Point, N. Y.

In a report on forests, prepared in 1913 for the Geological Survey of Alabama,[1] the writer divided the State into 15 main divisions and a few of lesser rank, listed the trees of each division with approximate percentages of abundance in the original and present forests, and gave some statistics of the amount of forest, density of population, number and capacity of sawmills, etc. The estimates of the percentage of woodland in each region were guesses based mostly on personal observation, for I had not then noticed that the government census reports for 1910 (and earlier) gave the amount of land in farms and woodland on farms for each county, from which the per cent of forest in any region could be computed more accurately.

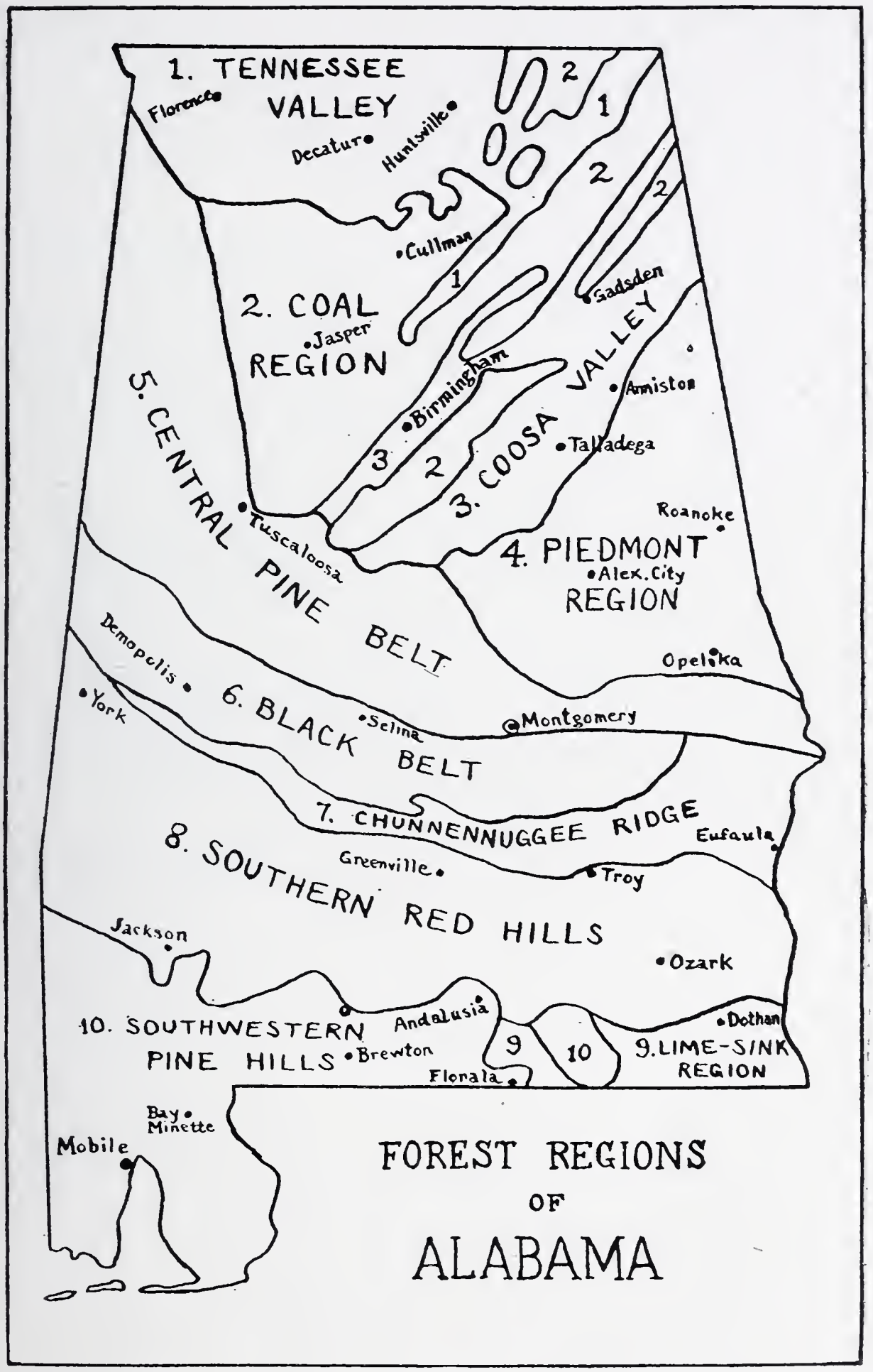
Two other sorts of statistics in government reports which would have made my treatment more complete were likewise overlooked. The census reports give the amount spent for fertilizers in each county during the year immediately preceding the census year, and the ratio between that and the acreage of improved land gives a pretty fair index of the fertility of the soil.[2] Lastly, a report on the lumber industry of the United States, published by the Bureau of Corporations of the Department of Commerce and Labor in January, 1913, contains a careful estimate of the acreage and standing timber owned or controlled by lumbermen in each of the more important lumber-producing States on January 1, 1911. The timber is divided into a few groups of species, and in the case of Alabama and a few other states the State is subdivided into several groups of counties, corresponding approximately with natural divisions.

Some of the geographical divisions described in my 1913 report are so narrow that they do not cover as much as half of any one county, and consequently the available county statistics cannot very well be applied to them. In the present paper these narrow belts are combined with adjoining ones, thereby reducing the number of divisions to ten, as was done in a preliminary paper on the subject in the Southern Lumberman for April 5, 1913, and in the abstract in American Forestry previously

[1] Monograph 8, or Economic Botany of Alabama, part 1; see abstract in American Forestry for October, 1913, and review in Forestry Quarterly for December, 1913.

[2] See Science II. 42: 500-503. Oct. 8, 1915.

referred to. The map used herewith is very similar to that used in the Southern Lumberman and identical with that in American Forestry and



the Forestry Quarterly. (It happens that eight of the ten statistical divisions of Alabama defined on page 285 of the Bureau of Corporations

report on standing timber correspond about as closely as divisions following county lines can with the same number on this map, and they must have been laid out with geographical contrasts in view. But the third and fifth are so heterogeneous as to be of no value for present purposes, and just what determined their selection is not apparent.)

The regions as here defined, with their areas, are as follows. Their location is sufficiently indicated on the map, and for notes on soil, topography, climate, etc., the reader is referred to the publications already mentioned.

1. The Tennessee Valley, including the "barrens" of the Highland Rim on the north—4,900 square miles.

2. The coal region, which can be subdivided into the plateau and basin regions—6,400 square miles.

3. The Coosa or Appalachian Valley region—4,000 square miles.

4. The Piedmont region, with the Blue Ridge along its northwestern edge—5,400 square miles.

5. The central pine belt, with three subdivisions—7,450 square miles.

6. The black belt or central prairie region—4,300 square miles.

7. The Chunnennuggee Ridge and blue marl region—2,300 square miles.

8. The southern red hills, together with the post-oak flatwoods on the north and the lime hills on the southwest—9,635 square miles.

9. The lime-sink or wire-grass region—1,350 square miles.

10. The southwestern pine hills, together with the Mobile delta and the coast strip—5,550 square miles.

The census of 1910 divides the land area of each state into land not in farms, improved land in farms, woodland on farms, and other unimproved land in farms. In a state like Alabama, which was originally almost completely wooded, except for a few prairies in the central portion (now nearly all under cultivation) and small marshes along the coast, the sum of the land not in farms and the woodland on farms gives a pretty close approximation to the present forest area. The "other unimproved land" is defined as including "brush land, rough or stony land, swamp land, and any other land which is not improved or in forest." The inclusion of swamp land in this category seems unfortunate, for in the South a swamp is always a forest; but the amount of forest slighted in this way may be just about counterbalanced by marshes, uncultivated prairies, towns and cities, roads, and farms overlooked by the enumerators.

Of the 32,818,560 acres of land in Alabama, the sum of the land not in farms and the woodland on farms, according to the census of 1910, was

21,531,012 acres, or about 65 per cent. Of this, 10,879,000 acres of forest and 435,000 acres with young timber or none at all (a little more than half the forest area of the State, or about 33 per cent of the total area) belonged to lumbermen on January 1, 1911, according to the Bureau of Corporations report. The total stand of timber on their land was 56,-300,000,000 feet, or 5,200 feet per acre. If the density of the rest of the forest is the same, the State total would be about 112 billion feet.

In the statistics for Alabama in the standing-timber report the trees are divided into three groups, namely, longleaf pine (which doubtless includes slash pine also), shortleaf and loblolly (presumably including also black and spruce pine), and cypress and hardwoods. It is evident that the lumbermen tend to specialize in longleaf pine, the most useful tree in the State, for the percentage of that in their holdings is considerably higher than the writer's estimate for the whole State and the several subdivisions. The percentages of hardwoods given are too low for the total stand of timber, doubtless because any one species of hardwood usually grows so scattered that it does not pay a lumberman to buy much land for the sake of the hardwood on it. If we multiply the figures for shortleaf and loblolly pine in that report by two and those for cypress and hardwoods by four, we will get a fairly close approximation to the total standing timber in each region—probably as nearly correct as could be obtained by using any other arbitrary multipliers throughout, for it makes the percentages of the pines too high in some regions and too low in others, but about right for the whole State. The percentages obtained in this manner can now be used as a check on my 1913 figures, which were derived in a rather crude manner (since improved on) from my field notes.

The following table is intended to partly supersede the list of trees on pages 189-191 and the table on page 195 of my report on the forests of Alabama. It gives for each of the ten regions and for the whole State the percentage of forests in 1910, the expenditure for fertilizer in 1909 per acre of improved land, the percentage of evergreens, and the percentage of the present forest made up by each species of tree (exclusive of the smaller and rarer species). Percentages are given only to the nearest integer, and consequently all below ½ are represented by 0; but where a given species is believed not to occur at all in a certain region, or only along its edges, dots are used instead.

In my 1913 report one could ascertain in which region any species was most abundant only by looking through the 19 regional lists; but this table shows it at a glance by bringing the percentages together in parallel columns. The highest percentages in each row are printed in

Regions.	Highlands.				Coastal plain.						Whole State.
	1	2	3	4	5	6	7	8	9	10	
Per cent of forest, 1910	57	71	66	55	70	40	46	61	54	90	65
Expenditure for fertilizer per acre improved land, 1909–10	$0.32	$0.83	$0.64	$0.95	$0.76	$0.35	$0.79	$1.14	$1.69	$2.09	$0.79
Percentage of evergreens	26	43	45	46	52	30	45	56	71	74	52
Trees:											
Pinus palustris (longleaf pine)	....	4	11	20	20	5	9	20	40	**50**	18
elliottii (slash pine)	....	....	....	....	....	....	....	1	7	7	2
taeda (shortleaf or loblolly pine)	7	18	18	10	**19**	10	13	12	8	4	14
serotina (black pine)	....	....	....	....	0	....	....	....	**1**	0	0
echinata (shortleaf pine)	3	**10**	8	9	6	5	6	5	1	1	6
glabra (spruce pine)	....	....	....	....	0	1	4	4	1	1	1
virginiana (cliff pine)	2	**6**	2	1	0	....	....	....	....	....	1
Tsuga canadensis (hemlock)		**0**	....	....	....	....	....	....	....	....	0
Taxodium distichum (cypress)	0	....	....	....	1	1	0	**2**	1	2	1
imbricarium (cypress)	....	....	....	....	....	....	....	....	**5**	4	1
Chamaecyparis thyoides (juniper)	....	....	....	....	....	....	....	....	....	**1**	0
Juniperus virginiana (cedar)	**12**	1	3	0	0	4	0	1	0	0	2
Juglans nigra (black walnut)	**1**	0	0	0	0	0	....	0	....	....	0
Hicoria aquatica (swamp hickory)	....	....	....	....	0	1	1	0	0	0	0
ovata (scaly-bark hickory)	**3**	0	1	....	0	1	....	0	....	....	1
alba (hickory)	1	2	1	2	1	1	0	0	0	0	1
glabra (hickory)	1	1	1	1	0	0	0	0	0	0	0
Salix nigra (willow)	3	1	1	1	2	2	3	2	0	2	2
Populus deltoides (cottonwood)	0	....	0	....	0	**2**	2	1	....	....	0
Betula nigra (birch)	1	1	1	0	1	1	1	1	0	0	1
Fagus grandifolia (beech)	3	**4**	3	2	3	1	2	2	1	0	2
Castanea dentata (chestnut)	1	**1**	1	1	0	....	....	0	....	....	0
Quercus alba (white oak)	2	3	**3**	2	2	1	1	2	0	0	2
stellata (post oak)	3	4	3	2	2	**5**	3	2	....	0	3
durandii	....	0	....	....	....	**1**	0	0	....	....	0
lyrata (overcup oak)	....	....	....	**0**	0	1	1	0	....	0	0
prinus (chestnut oak)	1	**3**	1	3	0	....	....	....	....	....	1
muhlenbergii	**2**	0	0	....	....	0	0	0	0	....	0
michauxii (swamp chestnut oak)	1	0	1	0	1	1	**2**	1	0	0	1

Quercus virginiana (live oak)	....	....	....	....	....	....	....	....	0	0	0
falcata (red oak)	5	4	3	3	3	4	3	3	1	1	3
pagodæfolia	...	....	0	0	0	1	0	1	....	....	0
velutina (black oak)	0	2	0	2	0	....	....	0	....	....	0
schneckii	1	....	0	....	....	1	0	0	0	....	0
coccinea (Spanish oak)	1	2	1	2	0	....	....	0	....	....	1
catesbæi (black-jack oak)	....	....	....	0	1	1	1	1	4	3	1
marylandica (black-jack oak)	1	2	3	5	3	2	1	2	2	2	2
cinerea (turkey oak)	....	....	....	0	1	0	0	1	3	2	1
nigra (water oak)	2	1	2	2	2	2	3	3	1	1	2
laurifolia	....	0	0	0	1	1	2	2	1	0	1
phellos (willow oak)	3	0	2	0	1	4	1	0	0	0	1
Ulmus americana (elm)	2	0	0	0	0	1	....	0	....	....	0
alata (elm)	2	0	1	0	0	2	1	0	....	....	1
Celtis occidentalis (?) (hackberry)	2	0	0	0	0	4	1	0	0	....	0
Morus rubra (mulberry)	0	0	0	0	0	1	0	0	0	....	0
Magnolia grandiflora (magnolia)	....	....	....	....	0	1	2	3	2	2	1
glauca (bay)	....	1	1	3	4	1	4	3	3	3	3
Liriodendron tulipifera (poplar)	2	3	3	3	4	1	3	3	1	1	3
Liquidambar styraciflua (sweet gum)	6	4	5	4	5	7	6	5	2	2	4
Platanus occidentalis (sycamore)	3	1	2	1	1	2	2	2	0	0	1
Prunus serotina (wild cherry)	0	0	0	0	0	0	0	0	....	....	0
Cercis canadensis (redbud)	1	0	0	0	0	1	1	1	0	....	0
Gleditschia triacanthos (honey locust)	1	....	0	....	....	....	....	....	....	....	0
Robinia pseudacacia (black locust)	0	0	....	0	....	....	....	....	....	....	0
Ilex opaca (holly)	0	1	0	1	1	0	1	1	1	0	1
Acer leucoderme (sugar maple)	....	0	0	1	....	....	....	....	....	....	0
floridanum (sugar maple)	....	....	0	....	0	0	0	0	1	....	0
saccharinum (silver maple)	1	....	0	0	0	1	1	0	....	....	0
rubrum (red maple)	3	4	3	3	3	1	2	1	2	2	3
negundo (box elder)	0	0	0	0	0	0	0	0	....	....	0
Tilia heterophylla? (lin)	0	0	0	0	0	0	0	0	....	....	0
Cornus florida (dogwood)	2	3	3	3	3	1	1	2	1	1	2
Nyssa sylvatica (black gum)	2	2	1	2	1	0	0	0	....	....	1
biflora (black gum)	....	....	0	....	1	1	1	2	2	3	1
uniflora (tupelo gum)	0	....	0	0	1	1	0	0	0	0	0
Oxydendrum arboreum (sourwood)	0	1	0	2	1	0	1	0	....	....	0
Diospyros virginiana (persimmon)	1	0	1	1	1	1	1	1	0	0	1
Fraxinus americana (ash)	1	0	0	1	0	2	0	0	....	....	0
caroliniana (ash)	....	....	0	0	0	0	0	0	0	0	0

heavier type (except where there is uncertainty about which is the highest) to aid the eye in picking them out, and also to indicate the most characteristic species in each region when one is running down one column at a time.

The technical names used are the same as in the 1913 report, and correspond in nearly every case with those in Sudworth's Check List, Mohr's Plant Life of Alabama, Small's Flora of the Southeastern United States, and Sargent's Manual. The common names are those used throughout the South, but not necessarily in other parts of the country. The names of evergreens are printed in heavier type, as in many of the writer's previous publications.

The probable quantity of any species in the State is of course the product of its State percentage and the total stand of timber previously mentioned. The evergreen percentages for the several regions are obtained by adding those in the columns and allowing a little more for rarer evergreens not listed.

Although only about half the known arborescent species in the State are represented in this table, it includes practically all that are of any commercial importance. It will be seen at a glance that the pines predominate, as in most of the other States bordering the Atlantic and Gulf coasts. If the figures are correct, no hardwood species constitutes as much as 8 per cent of the forests of any one region, as here defined (this would not be true of some of the smaller divisions in the more complete report, however), or 5 per cent of the standing timber of the whole State.

The evergreen percentages are generally highest in the regions with the poorest soils, as indicated by the amount of land remaining in forest and the sums spent for fertilizers on the cultivated areas. In the primeval forests the differences in evergreen percentages between the rich and poor regions would doubtless have been greater, for in the regions with rich soils most of the hardwoods have been destroyed to make room for crops, while in the sandy pine lands a large part of the pine has been removed by lumbermen, and the hardwoods, which are there chiefly confined to swamps, have been comparatively little disturbed.

It would be interesting if we could make an estimate for each region of the average stand of timber and its rate of growth and the rate at which it is being cut, but there are no sufficient data on these points at present. The timber is probably growing faster than it is being cut in some of the regions, but not in most of them. The most rapid growth is presumably on the richer soils, but the longleaf pine, the species most in demand, prefers the poorer soils and is probably not holding its own.

PROFESSIONAL ETHICS

By Theodore S. Woolsey, Jr.

The profession of forestry is now recognized in the United States as established. There are foresters in Federal employ, in the employment of the States, and in private employ, and, in addition, there are quite a number of consulting firms. The Society of American Foresters has been joined by most of the leaders in the profession, and should wield a considerable power in insisting that professional conduct be upon a high plane. One member of the Society resigned because his conduct was not considered such as to warrant his continued standing as an active member. As yet neither the Society nor any other body has placed itself on record as favoring any particular canons of ethics, such as have been adopted by the American Bar Association and by the American Medical Association. The only official expression as to professional ethics is contained in the rules for conduct, issued by the Forest Service November 14, 1914, as part of the National Forest Manual.

In these rules for conduct officers are forbidden to file or initiate land claims within the limits of National Forests, to become commercially interested in National Forest products or enterprises, to receive gifts from users, to grant privileges to members of their family or to be influenced by personal friendship or relationship in official action, to use information acquired through means of their official position when to do so would prejudice their official standing, "influence his official action, or tend to bring criticism upon the Forest Service."

Such a specific enumerating of acts which cannot be countenanced in National Forest administration naturally leads one to believe that all of these rules have been formulated because of violations during these first years of administration. It is difficult to completely summarize in a few words everything that is included in the Forest Manual rules for conduct, but perhaps the following would cover the essentials:

No member of the profession shall engage in any business transactions which might be questioned on account of his official position or which might influence his official action or his fidelity to his client or tend to bring criticism on the administration he represents. "He must set and hold to a high standard of personal conduct and integrity that will be a safeguard against criticism and embarrassment." Those under civil-service employment are prohibited by civil-service rules from political activity and are relieved from political assessments and contributions.

So far, so good; but should not the profession go further in indicating the ethics and etiquette which should govern the professional forester? In America, especially, where the success of public forest administration will depend to a large extent upon the integrity of the administrative officials, it is essential that the public shall have absolute confidence in this administration, and particularly in its official representatives. The danger line will always be when the public official must commit irregularities in detail for the alleged benefit of the broader administration policies; in other words, when an official must do wrong for an ultimate good. Perhaps it is along this line that the rules will bear amplification. While they apply admirably to the ranger or supervisor, they are too specific for the general practitioner.

Here there is a chance for two viewpoints: One that the official should not commit these irregularities, even if his goal is not attained; the other that these irregularities can be winked at on account of the final benefits to be received. I wish only to point out the danger involved, especially when subordinate officials take it upon themselves to be the arbiter in these cases. At best the very highest official will be perplexed in deciding between his professional and administrative duty.

The code of ethics adopted by the medical profession gives very little that would assist the forester. The canons of ethics adopted by the American Bar Association on August 27, 1908, and which were prepared by a committee of fourteen (Henry St. George Tucker, Virginia, chairman), gives a great deal of interest to the forester, and, to my mind, is a model which a committee of foresters might study with profit before drawing up a similar code. A brief review of these canons illustrates some of the problems which the forester must meet.

The committee set forth as a fundamental, that

"No code or set of rules can be framed which will particularize all the duties of the lawyer in the varying phases of litigation or in all the relations of professional life." . . .

Yet I am sure that every forester would be benefited by reading these canons, adopted by the most important bar association in the world. There is much that is common to other professions, both as to policy and as to specific duty.

In the selection of judges—rule 2, for example—the committee felt that the bar

. . . "should protest earnestly and actively against the appointment or election of those who are unsuitable for the bench; and it should strive to have elevated thereto only those who are willing to forego other employments, whether of a business, political, or other character, which may

embarrass their free and fair consideration of questions before them for decision." . . .

Under rule 3, lawyers are informed that

. . . "marked attention and unusual hospitality on the part of a lawyer to a judge, uncalled for by the personal relations of the parties, subject both the judge and the lawyer to misconstructions of motive and should be avoided. A lawyer should not communicate or argue privately to a judge as to the merit of a pending case." . . .

Here is a policy directly applicable to the relationship between administrative officers and permittees as regards accepting hospitality or personal favors, as well as personal unofficial intercourse regarding official cases.

According to rule 6:

. . . "It is unprofessional to represent conflicting interests, except by express consent of all concerned, given after a full disclosure of the facts." . . .

The application here is not so direct in the profession of forestry; but when a professional forester is constrained to support a policy which he believes will mean injustice to an individual, he should at least clearly put on record the reasons for lenient action toward an individual when in conflict with a fundamental Federal or State policy.

As yet there are but few consulting foresters. Therefore the last paragraph in rule 7, rule 11, rule 12, first paragraph, and rule 14 would not have the same interest to the profession as it does with the bar; they are sufficiently important, however, to justify quotation:

"7. Efforts, direct or indirect, in any way to encroach upon the business of another lawyer are unworthy of those who should be brethren at the bar; but, nevertheless, it is the right of any lawyer, without fear or favor, to give proper advice to those seeking relief against unfaithful or neglectful counsel, generally after communication with the lawyer of whom the complaint is made."

"11. Dealing with trust property.—Money of the client or other trust property coming into the possession of the lawyer should be reported promptly and, except with the client's knowledge and consent, should not be commingled with his private property or be used by him."

"12. Fixing the amount of the fee.—In fixing fees lawyers should avoid charges which overestimate their advice and services, as well as those which undervalue them. A client's ability to pay cannot justify a charge in excess of the value of the service, though his poverty may require a less charge or none at all. The reasonable request of brother lawyers, and of their widows and orphans without ample means, should receive special and kindly consideration."

"14. Suing a client for a fee.—Controversies with clients concerning compensation are to be avoided by the lawyer, so far as shall be compatible with his self-respect and with his right to receive reasonable recompense for his services, and lawsuits with clients should be resorted to only to prevent injustice, imposition, or fraud."

In rule 15 there is one sentence which certainly deserves quotation:

. . . "No fear of judicial disfavor or public unpopularity should restrain him from the full discharge of his duty."

Again and again in forest administration it will be necessary for the administrator to make decisions which will bring him personally into public disapproval. In such cases as this it would be very easy for the executive to plead reasons of policy for making the popular decision, in that popular disfavor against the administrator would also mean popular disfavor against the organization he represents.

In Europe, especially, it often happens that forest scientists engage in acrimonious and bitter disputes about technical problems. Discussions such as these would be of great benefit to the profession if they are conducted without personal animosity.

According to rule 17:

"Clients, not lawyers, are the litigants.—Whatever may be the ill-feeling existing between clients, it should not be allowed to influence counsel in their conduct or demeanor toward each other or toward the suitors in the case. All personalities between counsel should be scrupulously avoided."

Owing to the fact that in the early days of forestry in America it was necessary to wage a newspaper campaign in favor of forest policies and in advertisement of the work that was being done, the profession may overlook the impropriety of going into print. During the early days of the Taft administration the Forest Service, for example, was severely criticised, as an administrative unit, for writing and distributing fulsome articles about the work which it was doing. While the aim was for the good of forestry in the United States, yet the detail of self-praise certainly subjected the organization to just criticism. This is a point in professional ethics which undoubtedly should be emphasized, when it is the individual who is being advertised rather than a cause. It is significant that the Forest Service now prohibits the naming of individuals in news items. Formerly names were given in order to enhance the news value of the press notice.

In rule 27:

"The most worthy and effective advertisement possible . . . is the establishment of a well-merited reputation for professional capacity and

fidelity to trust. . . . Solicitation of business by circulars or advertisements or by personal communications or interviews, not warranted by personal relations, is unprofessional. . . . Indirect advertisements for business by furnishing or inspiring newspaper comments concerning cases in which the lawyer has been or is engaged . . . are intolerable."

There is a great deal of force in these injunctions which have been violated so frequently by professional foresters.

The general statement in rule 29, that the lawyer

. . . "should strive at all times to uphold the honor and to maintain the dignity of the profession,"

naturally applies with equal force to other professions, and all of us must subscribe to this extract from rule 32:

. . . "But above all, a lawyer will find his highest honor in a deserved reputation for fidelity to private trust and to public duty, as an honest man and as a patriotic and loyal citizen."

Of special interest to foresters is the code of ethics adopted by the American Society of Civil Engineers. Since it comprises but six short paragraphs, it is quoted in full:

"It shall be considered unprofessional and inconsistent with honorable and dignified bearing for any member of the American Society of Civil Engineers:

"1. To act for his clients in professional matters otherwise than as a faithful agent or trustee, or to accept any remuneration other than his stated charges for services rendered his clients.

"2. To attempt to injure falsely or maliciously, directly or indirectly, the professional reputation, prospects, or business of another engineer.

"3. To attempt to supplant another engineer after definite steps have been taken toward his employment.

"4. To compete with another engineer for employment on the basis of professional charges, by reducing his usual charges and in this manner attempting to underbid after being informed of the charges named by another.

"5. To review the work of another engineer for the same client, except with the knowledge or consent of such engineer, or unless the connection of such engineer with the work has been terminated.

"6. To advertise in self-laudatory language or in any other manner derogatory to the dignity of the profession."

Since under present usage the professional forester is not admitted to practice either by the Federal or State governments, there is all the more reason, to my mind, for appointing a committee from among the members of the Society of American Foresters to draw up a canon of ethics which should govern the conduct of foresters. It is a new profession in this country and there are innumerable pitfalls. Perhaps it is too early

to draw up such a code, and, so far as I know, there is nothing comparable to it in the literature of European nations. In the French codes there are administrative rules of conduct (enacted laws) similar to those promulgated by the Secretary of Agriculture. On account of the large amount of private land in this country and because of the increasing number of forest properties held as estates, eventually there will be, undoubtedly, at least a small field for consulting foresters. Therefore it seems to me that the profession should agree on general rules of conduct applicable to the public and private forester. Should the consulting forester speculate in timber lands in the region where he has clients? Should formal notice be served on tree doctors and the like that their practice does not come within the scope of forestry, as they often claim, owing to the fact that the word "forester" is often a catch-word for business? The Federal government would probably be jealous of having outsiders point out that too broad an interpretation of fiscal laws and regulations are serious irregularities which by right should disbar violators from the profession of forestry.

Too often a man who points out that this or that is not right is considered narrow. The broader-minded brother may authorize a trip undertaken for private reasons at public expense because he feels that the public salary is small. Is this laudatory broad-mindedness, or is it an offense against decency?

THE FACTOR OF TOP DIAMETERS IN CONSTRUCTION AND APPLICATION OF VOLUME TABLES BASED ON LOG LENGTHS

By Herman H. Chapman

Professor of Forest Management, Yale Forest School

Volume tables based on d. b. h. and 16-foot logs are commonly used in the West and South as a measure of merchantable contents. The actual used length, which seldom falls at an exact multiple of 16 feet from the stump, is rounded off in the tables to either the nearest full or half log. Since the volume tables are used not to scale logs, but to estimate the contents of standing timber, which will always be based on a definite log unit regardless of the utilization of the individual tree, this rounding off is necessary. The best plan is to measure the felled tree, not by the logs actually cut, but by 16 or 8 foot sections.

To get the full data on tree form, these sections would be taken to the tip; but the table itself must show only the actual merchantable contents, excluding the portion of the crown left to waste. The point at which the last saw cut falls determines this factor for each individual tree, and this so-called "top diameter," averaged for the species and region, guides the construction of the table.

Should it be concluded that the average top diameter for all trees is a fixed diameter—say, 7 inches—it would be possible to scale the merchantable contents of each tree from the analysis sheets, permitting the last 8 or 16 foot section to fall at the point nearest to this limiting top diameter, thus measuring all trees as if they were actually utilized to a 7-inch top.

But in practice, especially with heavy-topped trees, such as hardwoods, southern pines, and western yellow pine, the actual top diameter utilized is not a constant, but increases in direct relation to the d. b. h. For trees of the same d. b. h. the top diameter decreases, with increase in merchantable length. Top diameter for such species and conditions is therefore a variable based on both d. b. h. and merchantable logs, as is shown in the following table:

TABLE I.—*Average used top diameter, inside bark, for 600 longleaf pine trees, Coosa County, Alabama (from curves)*

D. B. H.	16-foot logs and half-logs.					
	2	2½	3	3½	4	4½
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
12	9.5	9.2	8.7	....	....	....
13	9.8	9.5	9.0	....	....	....
14	10.2	9.9	9.4	8.8	....	....
15	10.6	10.3	9.9	9.2	....	....
16	11.1	10.8	10.3	9.7	9.1	....
17	11.7	11.4	10.9	10.2	9.6	8.9
18	12.4	12.0	11.5	10.8	10.1	9.4
19	13.1	12.7	12.2	11.4	10.7	10.0
20	14.0	13.5	12.9	12.1	11.3	10.6
21	14.9	14.4	13.7	12.9	12.0	11.2
22	15.9	15.4	14.6	13.7	12.7	11.9
23	17.0	16.3	15.5	14.5	13.4	12.5
24	18.0	17.3	16.4	15.4	14.2	13.2
25	19.1	18.3	17.4	16.2	15.0	14.0
26	20.3	19.4	18.4	17.1	15.8	14.7
27	21.5	20.4	19.4	18.0	16.6	15.4
28	22.8	21.4	20.4	18.9	17.4	16.2
29	24.0	22.5	21.3	19.8	18.3	16.9
30	25.2	23.5	22.3	20.7	19.1	17.6
31	....	24.5	23.2	21.6	19.9	18.4
32	....	....	....	....	20.7	19.1
33	....	....	....	....	....	19.8

The false assumption of a constant or fixed top diameter in the preparation of either volume tables or tables of frustum form factors introduces elements which will almost certainly cause errors in the application of the tables in estimating. In timber estimating such a table can be correctly applied in but one way—by tallying the tree according to the actual number of logs, or merchantable height, to the specific constant diameter used in its construction, regardless of the fact that the actual used length may fall perhaps a log short of this point in the top. If this practice is rigidly adhered to, a deduction can be later computed representing the loss from waste through leaving tops, and the total estimate can be corrected by this factor.

But the natural tendency of cruisers is to tally the heights of trees to the point which represents used length, not to a fanciful standard diameter of top. If this is done, the volume table *must* coincide with these actual volumes, which means that it must be made by adopting the limit of tops set by custom, not one dictated by an arbitrary rule. In constructing the table the practice is either to measure the actual lengths of the logs cut or, better still, to adhere to the plan of measuring tapers

every 8 feet, but including as merchantable the 8-foot section whose top falls nearest to the last cut. This measurement may thus fall short of or beyond the saw cut, according to which point is nearest. The result is a volume table coinciding in all respects with actual average merchantable volumes, since the top diameters for the table agree with those actually cut.

The danger of misuse of volume tables, while much greater for those based on a fixed top diameter than for those constructed as described above, applies to *any* table of this character and needs explanation. A cruiser who tallies a tree as having 3 logs first selects by eye the point on the trunk which he regards as the merchantable limit, and then guesses at or measures the height to this point, rounding it off to the nearest log or half log. Whether he selects too low a point or underestimates the height to this point, the effect is the same; his 3-log tree has a top diameter larger than the top diameter of the average 3-log tree given in the table for the same d. b. h.—that is, in either of the above cases the "fixed" top diameter lies higher in the crown than the actual 3-log point. Since contents of logs are scaled by their top diameters, and since, by reason of a larger top diameter, this actual tree of 3 logs is a tree with less taper. each log in the tree has a larger diameter than that of the tree used in table and the total contents of the 3 logs is considerably more than shown by the table. The *loss* or underestimate thus caused is a much larger factor than the exclusion of the small log or half log at the top, which was not estimated. The following case, selected at random, will illustrate the possible error even when the volume table is based on actual, variable diameters:

Tree—D. B. H. 15″—4 logs—Rule, Doyle

	Actual top diameter of each log, inches.	Contents, board feet, interpolated to tenths.	Contents of first three logs.	Average top diameters of each log in a 3-log tree.	Contents of each log.
First log.....	12.9	81.3	.....	12.5	73.5
Second log.....	11.6	57.0	.....	11.2	52.
Third log.....	9.9	34.9	.....	9.4	29.4
Fourth log.....	7.8	14.3	.....	.....	.....
Total contents.	.....	187.5	173.2	.....	154.9

The cruiser tallies this tree as a 3-log tree. By the loss of the top log the error in the estimate would be $1.00 - \frac{173.2}{185.7}$, or 7.6 per cent. But he depends for his volume not on the actual tapers of his logs and their

true top diameters, as would be attempted in purely ocular estimating, but upon the volume of the 15-inch 3-log tree in the table, which is shown in the final column. The error here is $1. - \frac{154.9}{187.5}$, or 17.4 per cent, more than double the apparent or obvious error of omission.

Should the cruiser reverse the process and estimate to a higher point, or overestimate the number of logs in a given length, the errors would be of similar character, but plus instead of minus.

This double error is held within reasonable limits by care in estimating heights, close co-ordination between the standard of estimating and of utilization, and by the use of the variable or actual top diameter in construction of the table instead of the arbitrary or constant diameter. The difference between the tapers of the actual logs in trees of the same d. b. h. cutting respectively—say, 3 and 4 logs—is not apt to be excessive, since the 4-log trees may represent merely a closer utilization of trees of essentially the same form, measuring the same at the 3-log point.

But when all trees are measured to a rigid top diameter, neglecting actual usage, and the table constructed on this basis, these two sources of error are greatly increased, and the supposedly scientific improvement of the data is worse than useless.

Assuming in the above case that 8 inches was the arbitrary top diameter chosen, the 4-log tree is actually cut to this diameter; but if 3 logs are taken, the volume for the table will be that of a 3-log tree, measuring not 9.4 inches, but 8 inches, at the top. Assuming that the dimensions of the other logs suffer a corresponding diminution, we would have:

	Top diameter.	Volume.
First log	12.0	64.
Second log	10.2	38.6
Third log	8.0	16.0
Total volume	.....	118.6

The actual loss in estimating resulting would be $1 - \frac{118.6}{187.5}$, or 36.2 per cent. All that is required to actually incur a 25 to 30 per cent error in the use of such volume tables, even when the used merchantable lengths are accurately estimated, is to blindly apply the volumes from the table to trees of the given diameter and log length. Yet a forester is only too apt to fall into this error in his desire to standardize the volumes in his table by assuming a constant and small top diameter.

The second error, arising from applying a false volume from table to trees of given log lengths, is avoided by the cruiser who depends wholly on the log unit in estimating, arriving at his total by tally of top diameters, estimate of average taper, or use of the "log run" and average heights of his trees. It is also avoided by the forester when he can utilize total height in his tables, as is done for trees of regular form. But where, for convenience, log lengths are used as the basis of height, the forester, if he wishes to secure even reasonable accuracy, will be forced to observe the above precautions, both in the construction and application of such a volume table.

THE BILTMORE STICK AND THE POINT OF DIAMETER MEASUREMENTS

By Donald Bruce

During the past three or four years the Biltmore stick has largely replaced the calipers as an instrument for measuring tree diameters, except in the case of work demanding considerable precision. Its light weight and simple form have been the vital factors in its success, contrasting strikingly as it does in both respects with the calipers, which become exceedingly cumbersome when made large enough to measure the big trees of the western part of this continent. It has been considered slightly less accurate than the older instrument, but capable of a precision quite in harmony with the other measurements involved in a timber estimate. In the January, 1914, issue of the Proceedings the author presented calculations of the theoretical errors resulting from a number of causes, which indicate that among them the only serious mistake that can be made in using the stick is in the "arm length"—that is, in having the eye at a wrong distance from the tree. One other source of trouble was mentioned without any estimate of its importance, namely, the taking of the measurement at the wrong height. Data recently collected now indicate that the latter is perhaps the more important of the two.

It is not convenient to measure diameters breast high with the Biltmore stick, and any one who has used one for any length of time has doubtless realized how insidiously this inconvenience gradually raises the point of actual measurement. Even a very careful man (of average height) will almost always, after the painstaking caution which attends novelty has worn off, be found to be using the stick much more nearly at the height of the eye than of the breast. This results in a constant underestimate of the diameter measurements, varying with the taper of the tree between the two points.

To determine how serious this matter is, some 150 trees were measured at both 4 feet 6 inches from the ground, the conventional breast-high point, and at 5 feet 3 inches, which may be taken as a convenient standard for eye height. The trees were selected at random from an average mixed stand of sugar pine, yellow pine, Douglas fir, and white fir on the Plumas National Forest. The height of both points was accurately determined and the diameters of the trees measured with calipers, particular precau-

tions being taken to have the two measurements of each tree entirely comparable. Occasionally irregularities of the bark made the upper measurement the larger of the two; but such cases were included in the averages, since offsetting irregularities in the other direction doubtless occurred unnoticed. A curve of height on diameter for each species of the stand was prepared and the volumes of each tree found by using these curves in connection with the Forest Service volume tables based on diameters and heights. A false volume for each tree was also found, using the d. e. h. or diameter eye high measurement in place of the d. b. h. True and false volumes were then totaled for each species. The difference between the two is obviously the volume error which results from holding the Biltmore stick at 5 feet 3 inches instead of 4 feet 6 inches from the ground. It should be noted that the accuracy of the height curves or of the volume tables does not enter materially into the result, since both true and false volumes are calculated in the same way and the differences should be essentially correct. The following table resulted:

Species.	Number of trees.	True volume.	False volume.	Volume difference.	Difference per cent of true volume.
		ft. b. m.	*ft. b. m.*	*ft. b. m.*	
Sugar pine....	24	5,842	5,470	372	6.4
Yellow pine...	34	5,521	5,305	216	3.9
Douglas fir....	82	11,947	11,535	412	3.4
White fir.....	16	533	509	24	4.5
Total...	156	23,843	22,819	1,024	4.3

Only in the case of Douglas fir were there enough trees measured to bring to light any relation between the amount of error and the diameter of the tree. The following table, while based on too few tree measurements to be more than roughly indicative, approximates it for that species. The values are graphically averaged by a curve:

D. B. H., ins.	Difference between d. b. h. and d. e. h. ins.	Difference between d. b. h. and d. e h. in per cent of d. b. h.	Difference between corresponding basal areas in per cent.
10	.07	.7	1.4
12	.09	.75	1.5
14	.12	.85	1.7
16	.16	1.0	1.9
18	.19	1.05	2.0
20	.22	1.10	2.1
22	.26	1.18	2.3
24	.30	1.25	2.4
26	.34	1.30	2.5
28	.38	1.35	2.6
30	.43	1.43	2.7
32	.48	1.50	2.9
34	.53	1.55	3.0
36	.59	1.63	3.2
38	.66	1.73	3.4
40	.72	1.80	3.5
42	.79	1.88	3.7
44	.86	1.95	3.9

The per cent differences between the basal areas are an excellent index of the per cent differences in volume, since the heights of the trees are not in question, and the ratio between the contents expressed in board feet and cubic feet will not vary perceptibly for such small variations in diameter, and the volume error is considerably greater for the larger trees. This is just what would be expected to result from the characteristically "swell-butted" form of the larger trees, and as this characteristic is much more striking in other species than it is in Douglas fir, the same trend to an even more marked degree may well be expected in them. It is evident that the error may be disregarded without serious consequence in small timber, but unfortunately it is in the large timber where the error is most serious that the greatest accuracy is desirable.

The amount of the error is surprisingly large, but it is not felt that the particular stand measured was in any way exceptional. The trees were not unusually "swell-butted" specimens, and the five species are, with one exception, characterized by a rather small and low root swelling. While it is possible that certain species might yield smaller errors, others, such as the western red cedar and the western larch, would undoubtedly give much higher values.

It may be urged that no one would hold the stick at quite the height of the eye, and that a very little caution will keep the point of measurement down toward the breast-high point, and hence that only a fraction of the errors above calculated should be expected. There is some truth

in this point of view, although, in the opinion of the author, it will usually be found that from one-half to three-fourths of the error, depending of course on the individual, is normal, except in cases where unusual pains are being taken. But there is little justification in allowing even a small error that can be easily eliminated, and even less for forcing the user of the Biltmore stick to choose between a considerable error and an annoyingly inconvenient method of handling the stick.

The whole difficulty can be removed by preparing volume tables based on diameter eye high and taking the measurements at that height. This does not mean that the expense of preparing new d. e. h. volume tables is necessary, as the cost of converting a table based on diameter breast high into this form is exceedingly moderate. The only field measurements necessary are such as have just been described. Two or three hundred measurements should be an entirely satisfactory basis for a curve of d. e h. on d. b. h. for one species. After this has been prepared, the volume-table curves can be redrawn, putting each tabular value over the d. e. h. corresponding to its d. b. h., and from these curves the values corresponding to d. e. h.'s in even inches can be read. The whole process should not take two men more than a day, even for a table of unusually large range, providing the necessary trees of a proper variety of sizes can be conveniently found.

It may be urged that it is decidedly unfortunate to introduce a new basis for classifying trees in diameter. There is some reason in this point of view, which is not entirely contradicted by the fact that already we have two different diameter-breast-high points in use—the German and the English-American. However, it is not argued that the old basis be replaced, but merely that it be supplemented by the new. As there will always be a certain amount of work for which calipers will be used, and since these will represent the work demanding greatest accuracy, it seems that volume tables should continue to be prepared on the basis of d. b. h., and the supplemental d. e. h. tables deduced therefrom to be used exclusively for such rough work as will be done with the Biltmore stick. The extent of the error, which is now almost inevitable, is too great and the cost of avoiding it too insignificant to let this objection seem very serious.

WHAT IS A FORESTER?

By Frederick E. Olmsted, Consulting Forester

At the meeting of the Society of American Foresters in San Francisco last October, Mr. George M. Cornwall read an interesting paper on "The Forester's Duty Toward Lumbering," and the writer discussed "The Lumberman's Duty Toward Forestry." It seems to me that these two discussions deserve more than passing remark, mainly because of the different points of view advanced by the lumberman and the forester as to what constitutes the duty of the one to the other. Let me state that I do not assume to represent the opinion of all foresters on this subject, nor, perhaps, would Mr. Cornwall care to assume such a responsibility for all lumbermen. Nevertheless, owing to the national character and importance of the meeting before which the papers were read, the two divergent views should command more or less attention.

Briefly put, Mr. Cornwall's idea of the forester's duty toward lumbering was that he should be a sort of doctor and industrial economist, specializing in such problems as overproduction and underconsumption in the lumber trade; the purchasing power of farm tenants; the replacement of wood by cement and other materials; the utilization of by-products for pulp; the manufacture of wood for paving, excelsior, and many other things; the elimination of waste in sawing at the mill; constructive advertising of wood, and the business of distributing and selling forest products.

This is not forestry, nor are the men engaged in such work foresters. I admit that these problems are of vital importance to the lumberman's business, and that they should be studied and solved, possibly to a large extent by the lumbermen themselves. I suggest, however, that such problems are not essential parts of the forester's profession, and that they may best be attacked and settled by experts other than the forester.

As his name implies, the forester's work is in the forest. He is concerned in measuring the amount, kind, quality, and value of growing timber and in determining and applying methods for its protection; in mapping the land to show how the various bodies of trees are located and how they may best be cut and removed; and, where conditions warrant, in designing and putting into practice such cutting methods as will make present operations profitable while leaving the lands timber-productive. His highest duty and most difficult work is this problem of using a

natural resource without destroying it. It is odd, incidentally, that this problem has so far made but a slight impression on the lumberman. He has not only generally overlooked the possible advantage to himself in cases where he intends to hold his logged-off lands, but has also failed to realize that the State, when it begins to acquire for itself lands best suited to tree growth, will acquire first, and pay highest for, those lands which have been kept producing timber, not those which have been turned into non-productive wastes.

Mr. Cornwall stated that "a knowledge of logging engineering is the basis of true forestry." I should put it otherwise. Logging engineering is an incident to, not the basis of, true forestry. It is essentially civil and mechanical engineering and has to do, for the most part, with mechanical devices for the transportation of logs to cars and mills. Of this, to be sure, the forester should have a general knowledge. A part of logging engineering—the determination and detailed analysis of logging units—is true forestry; but a forester can no more pretend to be an expert in civil and mechanical engineering than an engineer can assume to be an expert in forestry. When the forester's plans involve technical details of railroad construction or the installation of logging apparatus nicely suited to given conditions, it is manifestly wiser to intrust the practical solution of these matters to men trained in the profession of civil or mechanical engineering.

One who specializes in the advertising of lumber or in problems connected with the distribution and sale of lumber is an advertising or traffic expert or a lumber salesman. He is not a forester. When the forester enters such work he leaves the profession of forestry and adopts advertising or salesmanship as a business. One who specializes in the preservative treatment of wood, or in the mechanical strength of wood, is an expert in chemistry or mechanical engineering. He is not a forester.

I admit that a man trained as a forester can be switched to a capable expert in one or more of the branches of work emphasized by Mr. Cornwall, but I believe it to be a waste of time, money, and training to adopt such a course. Experts in lumber economics, wood utilization, wood advertising, and wood selling might better be obtained from the ranks of economists, engineers, chemists, advertising specialists, and those versed in salesmanship; for the training and experience of the forester is of merely incidental advantage in such matters. The forester has a definite field as a forester in both governmental and private work.

It may be argued that the field for the forester's services, as here defined, is too limited to employ the large number of men now being ground out each year by the many forest schools of the country, and that,

as a consequence, the forester must be led into other callings. There are twenty-two forest schools in the United States which give degrees. The remedy for this state of affairs lies not in training an oversupply of foresters and then shunting them into lines of work which are but remotely connected with their training, but in the abolishment of nineteen of the twenty-two forest schools; for fully that number have no legitimate excuse for existence.

Then, again, why should not most of the experts mentioned by Mr. Cornwall be developed from the ranks of the lumbermen themselves? From the nature of their practical training and experience, should not lumbermen be well qualified to specialize in these fields? Moreover, if the forester be expected to diagnose the lumber business and become an expert in all its branches from tree to consumer, what is a lumberman? Has he made the best use of his opportunities?

THE ENGLISH NAMES OF SOME TREES

By W. W. Ashe

Forest Inspector, Forest Service

There is a noticeable difference between the literary English names and the vernacular names of many eastern trees, and for several years the causes for this have seemed a subject worthy of investigation. This difference between the written record and current vernacular usage has seemed the more remarkable from the unanimity with which the scholastic names are applied by present-day writers, and the fact that some of the names are homonyms, the literary name Spanish oak, for example, being popularly and apparently more properly applied to a very different tree. To the botanical fraternity such disparity is a matter of little moment, but the forester must necessarily live close to the land and come in touch with forest owners; and since his field is entirely an economic one, it is eminently desirable that the popular name should be the same as the scientific English term which he employs. Furthermore, the harmonizing of English names is the more necessary, since, on account of the chaotic state of systematic nomenclature, the English name is frequently more definite than the Latin equivalent.

It may be objected that any proposed alteration in usage involves change in reference to existing literature. This, however, has already taken place several times in the case of many of the systematic binomials. Another objection might be that a change imposes a hardship upon technical users. The trained forestral and botanical clientages, however, can accommodate themselves to such a change with far greater facility than laymen can be divorced from the inherited usage of two centuries. But, irrespective of objections, the consonance of literary and vernacular usage is of prime importance to the forester if his propaganda work is to reach effectively the largest body of property owners.

The early investigators and writers undoubtedly used the common local names of their period. It was André Michaux in his History of American Oaks (1801) and Michaux f. in his Hist. Arb. Amér. (1810-1813), and the American editions of this work which appeared subsequently, who are largely responsible for many of the present accepted literary names. Unfortunately, although both father and son traveled extensively in this country and were accurate observers, many of the terms which they proposed and which have since become established in literature were, so far

as popular usage is concerned, either local at the time of their writing or, if in general use then, they have subsequently become archaic or obsolescent. The appellations which they proposed, however, have been accepted without question by botanical writers, who have been too busy with other matters to make serious incursions into the field of vernacular terminology; and, unfortunately, foresters have adopted many of these same names transmitted by the botanists. The conditions which led to the use of most of these names in North Carolina forestral publications between 1893 and 1900 probably will explain their acceptance by other persons. It was realized that the local vernacular names differed from those employed, but they were taken without explanation, under the belief that, having usage of such authorities as Gray, Michaux, Chapman, Britton, and Wood, they must be the most appropriate terms. A field experience of many years has afforded convincing proof that this is not the case.

The origin of the use of some of these variants has been sought on historic grounds, but former usage will not afford an adequate explanation in all cases. The early writers who have been consulted are Lawson (1714), Catesby (1743), Kalm (1748), William Bartram (1774), Marshall (1785), and Muhlenberg (1801).

The histories of four of these names—scarlet oak, Spanish oak, pignut hickory, and loblolly pine—are especially remarkable. *Quercus coccinea* was called by Michaux (Hist. Ch., 18) scarlet oak, a mere translation. He states that the people generally distinguish this from the red oak, but he gives no common name. Michaux f. (op. cit., 2, 116) states: "In the Northern States it is confounded with the red oak and by those in the South with the Spanish oak. The name of scarlet oak was given it by my father,[1] and though not in use by the inhabitants, it would probably be adopted, as the tree is evidently a distinct species." Unfortunately his suggestion has been adopted, and its adoption has resulted in great confusion. *Q. coccinea,* however, was generally differentiated many years before Michaux wrote. Lawson, traveling in 1714, states (Carol.): "Spanish oak bears a whitish, smooth bark." Kalm, writing of New Jersey in 1748 (Trav., 1, 66), refers to "*Q*(*uercus*) *hispanica,* the Spanish oak, a variety of the preceding"—that is, the black oak, which he has just mentioned. Marshall in 1785 (Arb., 123) is extremely enlightening in regard to usage in the north during the period immediately antedating Michaux's investigations. *Q. palustris,* he states, is "generally known by the name of water or lowland Spanish oak." The next and contrasting species, *Q. montana,* which he accurately describes so as to apply only to

[1] There is a reference to the red oak as scarlet oak, however, as early as 1720.

Q. coccinea, has "bark lightish colored, leaves deeply sinuate; timber worm-eaten," and is "likewise known by the name of Spanish oak." The antonym of his Spanish oak is the nearly related *swamp* Spanish oak. Literature yet clings to *swamp* Spanish oak as a synonym for pin oak, but this tree and *Q. digitata* barely overlap in their distributions and have nothing in common in their habits. Spanish oak is today the prevailing name for *Q. coccinea,* as it was in Marshall's time. It is used through all the upland parts of the South; it is frequently heard through the North. Professor Gruber (in lit.) gives both scarlet and Spanish oak as being the common names in northeastern Pennsylvania. It is frequently heard in western and middle Pennsylvania and sometimes in New York State. Spanish oak should supplant scarlet oak; swamp Spanish oak then has its full significance.

There is evidence, however, that at least along the coast this name, Spanish oak, was formerly occasionally applied to *Q. digitata.* The reference to *Q. digitata* by Clayton in 1739 (Virg.) is "*Q. rubra* seu Hispania hic dicta." Elliott in 1828 (Fl., 2, 637) states that *Q. digitata* is called both red oak and Spanish oak. It is significant, though, that the *Q. rubra* of both Walter and Bartram is this species.

At present, however, *Q. digitata* is not called Spanish oak, as our literature indicates, unless it be in the very limited areas occupied by it in Maryland and to the northward or at some other point along the fringe of its distribution. Even in Illinois its congener, *Q. pagodæfolia,* is the "red oak" of the region (R. C. Hall, in lit.). Elsewhere it is known as red oak, and it is in fact the southeastern swamp red oak and should bear this name.

The following disposition of the oaks will accord well with current popular usage:

Q. rubro (of author's, not L.), red oak.

Q. digitata, southern red oak.

Q. pagodæfolia, swamp red oak.

Q. coccinea, Spanish oak.

Q. palustris, pin oak or swamp Spanish oak.

Q. schneckii, spotted oak. Prevailingly so called[2] in the middle and lower Mississippi Valley, where most abundant; a name also freely bestowed in that section upon *Q. coccinea,* which resembles it in leaf and bark.

Q. prinus L., swamp chestnut oak. Cow oak and basket oak are too local to justify perpetuation. Cow oak is heard occasionally in Louisiana.

Q. montana Willd. (rock) chestnut oak.

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[2] Lewis (Trees of Tex., 80, 1915) includes this among the Texas names of this species.

Q. catesbæi, sand (black) jack oak. This tree is known as sand or forked-leaf black jack[3] from Virginia to Alabama. Harper (Forests, Ala., 80 *seq.*) gives only turkey oak, but black jack is more commonly employed. Turkey oak is applied to any oak having small acorns on which wild turkey feed.

Q. cinerea, blue jack or barren or upland willow oak.

The misuse of the name "pignut" has bred confusion in the hickories. Michaux (Fl. Am. Bor., 2, 192) used the specific term *porcina* for a hickory bearing thick-shelled nuts, and Michaux f. discusses this tree (op. cit., 1, 206) under the name of pignut, a translation of the specific part of the Latin binomial. He states: "This species is generally known in the United States by the name pignut and hognut hickory." This statement and the use of his specific name *porcina* seem to have fixed this term in literature. He was followed by Nuttall, Pursh, Darlington, and Elliott. This sweet-kerneled hickory apparently is called pignut in a few places, but this name is more generally applied to *Carya cordiformis* (*Hicoria minima*). Michaux himself refers to it by that name (Journal, 125, under date March 16, 1795 [1888]) when he lists the trees on the banks (rives) of the Cheroquis (Tennessee) River: "Platanus; Juglans pecan; hiccori, pignut; Liquidambar," and other trees of river swamps. *C. cordiformis* and not *C. porcina* is the associate of the pecan in river swamps. Many examples will be found in herbaria of *C. cordiformis* with its long yellow valvate buds labeled *Carya porcina* or *Hicoria glabra,* a species entirely different in bud, foliage, and nut, merely for the reason that a very common name of "bitter nut" is pignut. It has also influenced the consideration of this tree by botanists. Darlington's description of *C. porcina* in 1837 (Fl. C., 547) embodies both species—leaflets "not infrequently in 4 pairs," "shell sometimes thin, kernel astringent and bitter." Dr. Gray segregated the two species in the manual, but placed them in the same group, and stated that his so-called pignut has fruit with a seed at first sweet, then bitter. The seed of the bitter nut has this effect upon the palate—that of all forms of *"glabra"* or *"porcina"* is sweet and edible. This confusion is so wide-spread that so recent a publication as the "Plants of Connecticut" accepted it as well as Emerson. As late a writer as Schaffner, a very thorough investigator of the characters of his local trees, has been led independently into the same error, describing (Field Man., 108) pignut as having "3-7, rarely 9," leaflets and seed "bitter and astringent, not edible"; specimens with 9 leaflets and bitter and astringent unedible fruit come only from the bitter nut,

[3] There are references to it as "forked-leaf black jack" in Georgia as early as 1797.

which, however, is popularly called pignut. The term pignut should be limited where placed by popular usage to the bitter nut. The name red (heart) hickory, which Muhlenberg in 1801 (Neue Schrift., 3, 391) states this tree was usually called in that part of the country, can fittingly be bestowed upon the several forms of "common hickory" with blunt buds and nearly glabrous foliage, dotted beneath with resinous globules, the "odorata" group. The members of this group are still generally called red (heart) or brown (heart) hickory in contrast with the other common hickory, which, having extremely thick white sapwood, is called white hickory. The smaller tree with the fig-shaped fruit and long buds and with leaves nearly destitute of resinous globules is of such little consequence that its English name is immaterial. Fignut, however, although entirely an arbitrary designation, in the absence of any distinctive name would be suitable. *C. villosa* (*Hicoria pallida*), as was stated in Garden and Forest, grows on poor and generally sandy soil and is frequently referred to as *sand hickory*.

The pines present the greatest difficulty. The application of the name pitch pine by Michaux f. to *Pinus rigida* and the general use of this name for this tree have resulted in serious commercial misunderstandings. This name is so generally applied to the longleaf pine, and its lumber is still shipped from south Atlantic and Gulf ports in such large quantities as pitch pine, that it is scarcely to be wondered that foreign purchasers of *Pinus rigida* seed should have been disappointed at the results of their plantations. If this tree were called black pine, a name often applied to it, this confusion would be eliminated.

Pinus tæda, except on the Delaware peninsula, is prevailingly known as shortleaf pine, and it would seem that a great step forward would be taken if the scholastic designation loblolly could be dropped, the trade term "North Carolina pine" surrendered, and both be replaced by this widely employed vernacular name; or the trade name could become "North Carolina shortleaf pine." Such a syncretism would greatly clarify this nomenclatural confusion. Michaux f. was likewise the proponent of the epithet loblolly for *P. tæda* and is responsible for the resultant confusion. He states (op cit., 1, 97) that this tree "is called loblolly pine throughout the lower part of the United States" and gives no other name. Nuttall in 1818 (Gen., 2, 223) refers to it as "old field" pine. This term, however, is used colloquially, not to separate different species, but merely as a designation of the character of stand, and is applied indiscriminately to any species of pine stocking land which has been cleared. It is possible that the name loblolly was in more general use at the time of Michaux's investigations, since Elliott's cursory

reference to it that "*P. heterophylla* is sometimes called *smooth bark loblolly*" indicates that it was employed on the coast of Georgia. But if the use of this name was then general, it has long since fallen into desuetude. These seem to be the only references to this name in early southern literature. The only localities in which it now seems to survive are northwestern Florida and certain parts of lower South Carolina immediately along the coast. Dr. Roland Harper, a most painstaking and conscientious recorder of vernacular names of the trees in the southern States, in reply to a personal inquiry stated that he had assurance that this name was used in this portion of Florida. This usage is corroborated by Supervisor Eldredge of the Florida National Forest. It is unknown in North Carolina except as a book name. Dr. Harper's regional records in Georgia and Alabama indicate that the same is true in those States. In a season's work in Louisiana and Mississippi this name was not heard. Notwithstanding the fact that there are local names for different quality site forms and stages of growth, shortleaf pine is the one general vernacular name for this tree from Norfolk, Va., to middle Louisiana. It may be stated that loblolly does not apply to the type of swamp in which *P. tæda* grows: it is one of the numerous designations given to the peaty soiled jungles which are generally known in North Carolina and South Carolina as pocosons, but sometimes as dismals, buckleberry or fetter bush or briery bays. The pine which grows in these swamps, *P. serotina,* the pocoson pine, is of low value, and the name loblolly pine, when used, is associated with this tree.

P. echinata is also widely known, both as shortleaf and yellow pine. However, it is economically by no means of the same importance as *P. tæda,* and, in addition to these, has other widely used names which are available. A distinctive one occasionally heard from Virginia to Louisiana is "rosemary,"[4] in allusion probably to its fragrance. The old timber of this species is marketed as shortleaf yellow pine to distinguish it from "longleaf yellow," on the one hand, and from "North Carolina" pine on the other. "Rosemary shortleaf" would give a distinctive appellation and one that would meet trade requirements.

The exclusively literary name pond pine for *P. serotina,* a tree which occupies in Virginia and the Carolinas several hundred thousand acres of pocoson land, should be changed to pocoson pine to conform to a wide usage. It is occasionally called black pine. Table mountain pine could well be shortened to mountain pine.

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[4] In Bulletin 6. N. C. Geological Survey, rosemary pine is quoted as a name for *P. tæda.* This reference was incorrect. These large and beautiful trees with thin sapwood and soft, bright yellow heartwood are *P. echinata.*

White ash is generally so designated. Green ash, while often thus called, is frequently denominated river ash, which is accurately descriptive of its habitat. The name pumpkin ash for *Fraxinus profunda* is not only too local to be perpetuated, but is a too depreciatory appellation for such a fine tree. It is frequently called deep swamp ash in the southeastern States, a name which not only describes its habitat, but is a translation of *"profunda."*

F. caroliniana is well called water ash.

SCIENTIFIC NOTES AND COMMENTS

Importance of Source of Seed in Forestation

There is but little accurate information on this subject derived from data gathered in the United States. The reason for this is not inactivity, however, but rather the fact that the characteristics of a certain kind of seed may not be brought out for 25 years or more, and forestry in this country does not date back that far. The Federal Forest Service and various States are now undertaking considerable experimental work along this line, the forest schools aid in a small way, and a few timber-land owners are interested.

While conditions in America are very different from those existing in Europe, it is believed that certain facts governing tree growth apply more or less, regardless of locality. For example, if tree seed from definite locations in Europe has been found through numerous painstaking experiments to reach its optimum development within a limited latitudinal and longitudinal as well as altitudinal range, fair development in a twilight zone surrounding this area, and to prove an utter failure in a third, more distant, region, it is reasonable to conclude that American tree species are affected in a similar manner.

Experiments with Scotch pine and Norway spruce seed from different habitats have been carried on in most of the European countries with invariably the same result—that seed from the north or a high elevation produce trees with a poorer development in the south or at a lower elevation than trees from local seed. Furthermore, it has been proved that seed from a high altitude is far superior to lowland seed in the mountains. The climate is the deciding factor. Trees in a severe climate naturally become hardy and produce seed which retains the characteristics of the parent trees when transplanted under more favorable conditions. As a matter of fact, trees from such seed grow at the same slow rate in the new locations as did the trees from which the seed originated, and consequently considerably slower than the plants growing locally. On the other hand, southern plants at a low elevation are acclimated to a long vegetative period and retain this characteristic when planted in a hardy climate. The consequence is that they suffer from frosts in the spring and fall, often become deformed, and sometimes result in total failure.

When forestry was first undertaken in the Scandinavian countries,

about 60 years ago, Germany already had a well-organized profession. As a natural consequence of this, the German example was followed and German foresters were imported to initiate the fundamental policies for these countries. Seed was obtained from German seed-extracting stations, plants from their nurseries. The seed was first class, as well as the plants, and, taking into consideration the fact that northern Germany is less than 100 miles from southern Sweden, the result has been astounding. Some plantations were total failures, others showed excellent growth during good seasons; but every tree that lived became so crooked by the time it reached pole size that it was practically worthless. A typical illustration of this can be seen at Finnerödja, Sweden, where a stand of Scotch pine 50 years old, of considerable size, has only a small value for fuel. It now awaits slashing and reforestation with local seed. There are any number of similar examples in other parts of Sweden and Norway.

The Scotch pine (*Pinus sylvestris*) is a native of both Scotland and Germany, but seed imported from the former to the latter place long ago proved its inadaptability to a degree that further importations were forbidden by law in order to protect the public. Both Norway and Sweden are extremely long countries from north to south, with great variations in climate. Seed from the southern part of either of these countries cannot be used in the northern sections, and vice versa. To determine how far seed can be used from its point of origin without impairing the growth and quality of the resulting trees has been studied by the Swedish Experiment Station for some time. Of particular interest is a table prepared by Dr. Gunnar Schotte, director of that institution, on an experiment commenced in 1909. It tabulates the locality from which the seed was derived by latitudinal range, which conveys the meaning more directly to the foreign reader than a name, which at best is hard to locate. While this experiment is still too young to enable one to draw definite conclusions, certain characteristics have already been brought out so plainly as to render the table of great value.

The plants were growing under identical conditions, according to Dr. Schotte, who goes on to say that the southern plants died from the top down and some had only one green limb close to the ground. The plants were not afflicted with fungus of any description.

It has happened, even in comparatively recent years, that seed from the southern part of Sweden has been used in the north (Norrland), which accounts for the frequent failures in that part of the country. Dr. Schotte warns the timber owners in Norrland to use only seed of local origin, and advises timber owners throughout Sweden to obtain seed as

close to their own locality as possible, even when conditions for growth are very favorable. In other words, the importance of using local seed becomes preponderant as the growing conditions become unfavorable.

Can the facts worked out by Dr. Schotte be applied to the seed of the various trees in the United States? It is known that they hold in the case of agricultural and horticultural crops, as well as in the animal kingdom, and there is no good reason why forest trees should form an exception, or why they should be subject to different fundamental laws of nature than are foreign species.

Statistical information regarding four-year-old plants from seed of different habitats in Sweden

[Experiment carried out at the Altrask Nursery, Boden National Forest. Latitude, 65° 40′]

SCOTCH PINE (PINUS SYLVESTRIS)

Origin of seed.		No. plants.	Condition of plants.		
Locality.	Latitude.		No. alive.	No. dead.	Per ct. dead.
Smaaland, Remma	50° 35′	674	2	672	99.7
Smaaland, Bottnaryd	57° 47′	1,296	7	1,289	99.5
Smaaland, Hassleby	57° 38′	156	1	155	99.4
Smaaland, O. Holaveden	58°	942	12	930	98.7
Östergötland, Atvidaberg	58° 11′	714	6	708	99.2
Vestergötland, V. Kinneskogen	58° 39′	582	38	544	93.5
Södermanland, Jonakers allm	58° 50′	600	14	586	97.7
Södermanland, Skogshall	59° 13′	524	63	461	88.0
Vestmanland, Bjurfors	60° 8′	181	128	53	29.3
Gastrikland, Hillevik	60° 48′	455	428	27	5.9
Dalarne, Fagerberg	60° 50′	400	368	32	8.0
Dalarne, Hamra	61° 35′	185	181	4	2.1
Jämtland, Bispgården	62° 50′	225	223	2	0.9
Vesterbotten, Hallnas	64° 15′	420	414	6	1.4
Norrbotten, Fagerheden	65° 15′	455	442	13	2.9
Norrbotten, Karl Gustavs socken	65° 55′	300	295	5	1.7

The behavior of western yellow pine in the Beaver Creek Nursery, Utah, appears to furnish rather striking evidence in support of this view. The yellow pine throughout this section of the country is divided distinctly into two separate belts, although the species is regarded as botanically the same. The southern belt comes up from Arizona and reaches its maximum development in the northern part of that State and the southern extremity of Utah. Small patches occur on the Fishlake, Manti, and Ashley National Forests, while still farther north only a few stragglers appear at considerable intervals.

In the northern belt, however, the species reaches a high development in the central part of Idaho, and does not extend much farther south than Boise. The interval between the sentinels of the two belts is approximately 175 miles, and this distance can be doubled before comprehensive stands are reached.

The climate in the south is dry, with long seasons of drouth as compared with Idaho, which has a somewhat heavier precipitation more evenly distributed throughout the year.

There are marked differences between the plants grown from Utah and Idaho seed in the Beaver Creek Nursery, which is located in the northern part of Utah, at an elevation of about 7,000 feet. During the first year the seedlings do not even resemble each other, the Utah pine having a distinct bluish or purplish color, while the Idaho seedlings are decidedly green. In rate of growth there is another marked variation, since it takes the Utah pine three years to reach the size of a northern two-year-old. This fact has led many to the conclusion that yellow pine from Idaho must be superior to Utah stock within the range of the latter. This view seems reasonable at first glance and time may prove it to be correct. Up to this time, however, there is no scientific information available on older plantations to settle the question, and the writer takes exception to the above logic. From an ecological point of view and on the basis of facts brought out in this article, there is really no reason why the more rapid growth of northern yellow pine should be surprising. It is naturally a fast-growing tree in Idaho and it retains this quality in Utah. The southern yellow pine is naturally a slow-growing tree, hardened to long periods of severe drouth, and it is very doubtful whether the northern variety would prove itself superior to the Utah pine in the field when deprived of the regular watering it obtained in the nursery.

It is likely, then, that the facts established in Europe not only hold true for the United States, but are even of infinitely greater importance, because of the enormous range covered by individual species, latitudinally, longitudinally, and altitudinally, with correspondingly decided differences in climate. Since the optimum range is not known as yet for any species at any particular point, it would seem wise at present to favor local seed, rather than to run the risk of failure in the twilight zone and beyond.

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Heavy Damage from January Storms in Southwest

The recent January storms which wrought so much damage throughout the west coast and Rocky Mountain region vented themselves in an unusual manner in the mountain ranges of southern Arizona, where in the oak woodlands some 400,000 cords of wood were broken down and destroyed by weight of the snow. While the storm was raging in southern California and easterly through Colorado, a rain, followed by sleet, then soft, wet, heavy snow, which continued for two days, fell over the wooded hills and mountains north of the Mexican border. Throughout the Patagonia and Santa Rita Mountains, the Canille Hills, and the Huachuca and Chiricahua Mountains the snowfall. amounting even on the lower elevations to from 20 to 26 inches, is said to be the greatest known since 1880.

The snow, very wet and heavy, did immense damage to the stands of live oak through this general region. While these trees are capable of withstanding heavy winds and other forms of the wrath of the elements, they seem to be particularly susceptible to damage from heavy snow. There are several reasons for this susceptibility. The chief is probably the fact that their broad leaves, as compared to the conifers, persistent throughout the year, are able to gather and hold together large masses of snow until sufficient weight has accumulated upon the branches to break them down. Furthermore, the straight forked and angular nature of growth of their trunks and limbs, coupled with the fact that practically all are subject to heart rots, makes them extremely susceptible to damage from direct weight from above, as in a heavy snowfall. Many individual trees were entirely denuded of their branches, while those with forked stems were split the length of their trunks and in many cases completely broken down at the forks.

The chief species here, and consequently the one suffering most damage, is black oak, *Quercus emoryi;* but the other live oaks, including white oak, *Q. arizonica,* and blue oak, *Q. oblongifolia.* were subjected to much destruction. Less damage seems to have been done to the coniferous species at higher elevations, possibly through their being accustomed to heavy snowfalls.

At Rodgers' Ranch, in the Canille Hills, west of Fort Huachuca, enough branches and heavy limbs fell from four black oaks in the yard about the house to make, when worked up, three cords of wood. Local forest officers estimate that from one to two cords per acre were destroyed through the heavier wooded belts, and that 200,000 cords were broken down in the Santa Rita and Huachuca divisions of the Coronado National Forest alone, and 100,000 cords in the Chiricahua Forest; so that the total destruction will probably reach 400,000 cords.

It is obvious that in from one to two years the broken limbs and branches lying in piles or thickly scattered about the base of each tree will become a serious fire menace. In an attempt to obviate this fire danger and obtain the removal of the destroyed timber from the forests, local officers of the Forest Service are taking active steps to promote its disposal by sale.

Forest telephone lines running through the woods here also suffered much damage from falling limbs and broken trees. A rather curious but altogether kind providence seemed to care for the large number of cattle grazing over the ranges here. When the storm began the stock naturally gathered under the nearest trees for protection, and as it wore on and the snow continued the twigs, then the larger branches and limbs, all bearing their green leaves, excellent winter browse, began to fall as manna from the heavens to the cattle beneath. By this means, and much to the delight of the cattlemen, they were well fed long after the storm had subsided.

From such evidences as would have been recorded in the growth of individuals it does not appear that such a storm, or at least one whose results were similar, has occurred over this region in the past 80 years.

C. W. McKibbin.

Coronado National Forest.

Checking Check Scalers

In the fall of 1914 a notable conference of officers engaged in scaling and in check scaling was held at one of the logging camps on the Coconino Forest. The object of this conference was to find out by a definite check on 400 logs how the men were scaling in comparison to one another. It was also hoped that by a discussion of the allowance for defect of the individual log scale that the instruction thus secured would be of lasting benefit. Two days were devoted to the work, and each participant submitted the following data for each numbered log:

1. Serial number.
2. Sound logs.
    - *a.* Length.
    - *b.* Scale.
3. Unsound logs.
    - *a.* Length.
    - *b.* Scale.
    - *c.* Amount allowed for defect.

Unfortunately each scaler was allowed to total and compare the first day's scale (200 logs); unquestionably, those who found they were scaling high unwittingly lowered their scale on the next day. It would have been very much better if no attempt at comparison had been made until after all the 400 logs had been scaled. At the end of the second day two committees were appointed to rescale every log and compile a committee scale. The committee scale in the final comparison was taken to be correct.

The first factor disclosed by the conference was that even check scalers failed to scale and record logs with sufficient care. Some logs were not properly recorded and scaled according to number; log lengths were sometimes omitted. Quite a few men scaled logs twice; sometimes the scale for two logs was transposed, and occasionally scalers failed to record the Scribner Decimal C Scale, but instead gave the full scale of the log in units instead of in decimals. There was considerable variation in the number of logs culled. One scaler, for example, failed to cull no less than 16 logs, which were culled by the committee. After the tabulation of the scale was completed, the original sheets of each scaler were returned to him, together with a blueprint copy of the correct committee scale, giving for each log, classed as to whether sound or unsound, the length and net scale. By a comparison each man was enabled to check over for his own information the errors which he had made. To assist him in this work, he was furnished an analysis of his errors: where he had entered the wrong length, where he had erroneously culled logs or failed to cull logs. Marked differences in allowing for defect were noted by specific number. An analysis of the aggregate scale of each man is shown in the following table:

Scaler.	Rank on basis of total per cent.	Rank on basis of average per cent.	Per cent variation.				Total per cent error.	Average per cent.
			1st 100.	2d 100.	3d 100.	4th 100.		
A	7	2	+4.4	+2.3	—6.6	—4.0	17.3	—0.8
B	3	3	+4.0	+1.2	+3.5	—1.3	10.0	+1.1
C	9	11	+6.1	+3.5	+5.2	+5.9	20.7	+5.0
D	5	6	+5.2	—0.4	+2.7	+5.1	12.4	+2.5
E	6	10	+8.0	+2.2	+4.3	+1.8	16.3	+4.9
F	8	5	+5.8	—1.2	+6.5	—5.7	19.2	—1.8
G	6	9	+6.9	+1.0	+4.5	+3.9	16.3	+3.8
H	1	4	+5.5	—0.4	+2.0	+0.7	8.6	+1.5
I	4	7	—1.2	—5.6	—0.1	—3.7	10.6	—2.7
J	2	3	+1.5	+0.9	+4.1	—2.5	9.0	+1.1
K	10	1	+8.7	+3.5	—6.7	—6.1	25.0	+0.2
L	11	12	+5.7	+6.3	+7.8	+7.0	26.8	+6.7
M	5	8	—4.5	—7.7	0.0	—0.2	12.4	—3.4
N	12	13	+10.2	+11.1	+5.4	+8.2	34.9	+8.6

After the results were compiled and compared, the question arose as to what criterion to apply in determining who made the best scale. At first it was natural to argue that the man whose total scale for the whole 400 logs came nearest to that of the committee should be termed the best scaler. It so happened, however, that the total or average scale of one of the least experienced of the scalers compared most nearly to the total or average committee scale, namely, scaler K, in the foregoing list. This aggregate similarity, however, was evidently due to his making large plus errors the first and large minus errors the second day. Obviously, this scaler was debarred by the gross errors of his first day's scale, when he was 8.7 and 3.5 per cent above the committee.

Another way of judging excellence was to add up the total plus or minus per cent differences between the individual scale and that of the committee. According to this method, scaler H, also an inexperienced scaler, made the best scale. The final award was made to J, who ranked 3 and 2 respectively according to the two comparisons, and who made almost no errors as to accuracy in the scaling of individual logs. It was unquestionably true that scaler J was the most experienced scaler of those who took part in the conference.

To pursue this criterion further, let us suppose that five men—A, B, C, D, and E—engage in three scaling conferences. Their relative percentage of errors as compared with the ideal scale is given in the following table:

Scaler.	Error.	Error.	Error.
A	+2	—2	+2
B	—4	0	—4
C	0	+4	0
D	+2	+2	+2
E	—2	—2	—2

If you decide excellence on the basis of total scale, A would win, with C second. If, however, the criterion is the least deviation from the correct scale in per cent, then C is first and A second. Average of the two methods would tie A and C for first place; yet, apparently, D and E are the most consistent scalers in comparison with the correct scale, D being high and E low by the same amount. My personal judgment is that, all other things being equal, A should be judged the best scaler, if, after an analysis of his scale of individual logs, no serious errors are discovered. One of the lessons taught by the 1914 scaling conference is one well known to experienced lumbermen, namely, that check scalers must use

the utmost care in instructing scalers to raise or lower their scale on account of the judgment involved in scaling defective logs (about half the logs in this conference were very defective). It is essential that the mental balance of scalers be left undisturbed after check scaling. It is far better to point out individual errors and explain why the scale was incorrect in particular logs rather than to draw general deductions as to total scale.

On account of the financial importance of correct scaling, check scalers will always be of value in large organizations, such as the Forest Service; but correction can best be made through judging methods in scaling single logs rather than by sending the scaler a sheet showing the comparison between the original scale and that of the check scaler, as is now required by the Forest Service scaling instructions.

THEODORE S. WOOLSEY, JR.

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EFFECT OF ROADSIDE TREES

The value of having trees along public highways is now almost universally recognized. If one hears an occasional objection to them, it is not because the general advantages of roadside trees are not appreciated, but because thorough consideration was not given to the location of the trees or the construction of the road itself.

One frequently hears the complaint that trees favor the accumulation of snow on roads and retard drying after a storm. These objections are only in part supported by facts. Snow tends to drift on the leeward side of a tree, but on the windward side and directly under the crown it is usually much below the average depth. This is due to eddies formed by the wind sweeping around the tree. Snow melts more slowly and the ground dries more slowly on the north side of a tree than in the open, but it is also true that both melting and drying are hastened on the south side, or under the crown. In Arizona it is common to see the ground entirely bare within a radius of from 10 to 20 feet around the base of a yellow pine, while in a near-by opening the snow is 2 feet or more in depth. This condition is explained by several factors. In the first place, less snow accumulates on the area close around the base of the tree and extending 10 or 20 feet to the south. In the second place, melting on this area is greatly accelerated by the reflection of heat from the tree trunk and the action of the crown in checking the loss of heat by radiation.

The above observations were made mainly in the Southwest, where the prevailing winds are from the southwest and the sunlight is exceedingly strong, even in winter. The same principles hold in other regions, but the results may be different, due to a difference in prevailing wind direction and less intense sunlight.

With respect to their bearing upon road location in Arizona and New Mexico, the preceding observations may be summarized in the following statements:

Trees standing on the south side of a road are more or less objectionable in winter, particularly in regions of heavy snowfall, unless they are so close that the crowns extend over the road, in which case they afford a decided protection against snow.

Trees standing on the north side of a road render a distinct benefit in warding off snow and in hastening melting and evaporation.

The influence of trees on the east and west sides of a road is intermediate between that of trees on the north and south sides. Trees on the east side may be regarded as generally beneficial, and those on the west side generally detrimental.

Whether the above facts should be applied to the extent of removing trees on the south and west sides of a road depends upon the seriousness of the snow situation and the extent to which the road is used in winter. There are cases in which the felling of trees is undoubtedly warranted. In other instances the same results can be attained by pruning. Indiscriminate cutting should never be allowed. This is a problem which requires careful study and deserves increased attention in the Forest Service.

G. A. Pearson.

Fort Valley Experiment Station,
April 7, 1916.

REVIEWS

Forest Valuation [1]

Professor Roth's Forest Valuation will be welcomed as a text-book and manual for the forest student. The great task of an author in dealing with this subject is to present it in a clear, simple, and practical manner, which may be readily followed by the reader, without confusing him with theories and formulæ. Professor Roth is eminently fitted, both by temperament and training, to accomplish this task, and he has succeeded.

The manual does not pretend to be an exhaustive treatment of the field of valuation and statics, and many questions, especially those of doubtful status, are briefly treated or dismissed with a sentence. The author's aim throughout has been to state only such facts as his readers might be expected to readily comprehend, yet no important topic is left untouched, and, by elimination, the resultant text comprises what may fairly be claimed as the basic principles of forest valuation explained in words of one syllable.

This is well shown in chapter II, entitled "Arithmetic of Forest Valuation," which contains a brief but lucid explanation of the fundamental formulæ of compound interest. Under chapter III, "Application of Valuation," the subjects of the interest rate and valuation of land and timber are covered. The economic status of forest production is here summarized and the advantages stated. Under "Risk in Forestry" the author takes an extremely optimistic position when comparing the risks in timber production with those in agriculture and other lines of enterprise, even claiming that under our present conditions of neglect and lawlessness, fire losses in our forests are relatively small, amounting to 10 cents per acre annually.

The problem of the rate of interest in forestry is solved by assuming that the rate which a forest can earn should be the rate at which it is valued. This contention meets with the opposition of authorities who regard the rate of interest on money as the means of determining all values—by capitalization or discount—and would therefore fix it at 5 or 6 per cent, without regard to forest conditions or the accumulation of compound interest. Roth further justifies the use of rates as low as 3

[1] By Filibert Roth. Published as Volume II of the Michigan Manual of Forestry.

and 2 per cent by citing statistics of the U. S. Department of Agriculture to prove that the net income earned on agricultural investments averages 2 per cent annually.

After developing the expectation value of soil, the author devotes 23 pages to a careful analysis of the factors which determine this value. This is in keeping with the prevalent practice abroad, where soil value is based entirely upon its capitalized income, exclusive of cost, and where sale value, in such rare cases as occur, would undoubtedly be determined in the same manner, and by using the standard, low, rates of 2½ to 3 per cent. Under the heading "Final Cut," it is shown that the actual yield of spruce in Württemberg is 73 per cent of the maximum possible yield of fully stocked stands. The items of thinnings, planting, annual expenses, and rotation are analyzed with regard to their effect upon soil value and figures given as examples. The interest rate is here brought in again, and it is stated that a rate of 5 per cent would probably prove 90 per cent of European forestry a failure.

Three per cent is advocated as a uniform rate for forestry calculations; but 2 per cent is necessary before the period of culmination of soil value is lengthened sufficiently to agree with the best technical rotation. The acceptance of *Se* as a measure of relative profitableness of forestry with agriculture and of one silvicultural method with another is defended from the criticisms, first, that forestry as an established business does not start with bare land, but with a growing stock; second, that prices will rise; third, that "reasonable" rates of interest give negative land values. At the same time the fallacy of "financial" rotations is pointed out, since market values for inferior material or small sizes would be lowered by overproduction through the general adoption of short rotations.

Under "Value of Growing Stock" an interesting and lucid discussion is presented of the method of rating a normal forest.

Chapter IV, entitled "Relation of Capital and Income in Forestry," deals with forest statics. The general discussion of "profit" here hinges on a series of illustrations, leaving the student to draw his own deductions as to the possible conceptions and uses of the term. The rate of interest earned in forestry is treated first as current value increment per cent by the formula

$$1.0p^n = \frac{Y^{x+n} + S + E}{Y^x + S + E}$$

where $n =$ the current period, x the age at beginning of period, and p includes value and price increment.

This same method is then used to determine the per cent earned during the rotation on an even-aged stand. The conception of regarding the

expense E and planting cost C as borrowed money earning the fixed rate p, as advocated by Sterrett, is briefly discussed. Anticipated earnings, expressed as "rate of interest in a forestry enterprise, starting with bare land," are set forth, following the "mean annual forest per cent" method of European authors—that is, $\frac{Se}{Sc} \times P$, which always exaggerates the per cent earned, through not computing it as a rate of compound interest, but a mere relation between expectation and cost values. The method,

$$1.0x^n = \frac{(Y + S_v + E) - (C + E)\,1.0p^n}{S_c}$$

which expresses the rate of compound interest earned on bare soil by the net investment, is not given.

Chapter V further sets forth the two conceptions of rotation, based on largest net income per acre of forest, or "forest rent," and based on the highest soil expectation value, or "soil rent."

The discussion of stumpage value in chapter VI is very brief and by no means covers the subject, though, as usual, the main points are all mentioned briefly. The statement is made, for instance, that the appraised value of stumpage for immediate cutting must be discounted in the form of an expectation value for stumpage which cannot be cut for some years, and that actual stumpage prices are not determined by appraisal of lumber prices and logging costs, but by supply and demand, land laws, and other economic facts. But the discussion does not cover all the elements involved, some of which offset the discount for expectation or waiting, such as the greatly increased value of large holdings of timber capable of economical transportation, as against small scattered holdings. Methods of appraising the value of several species in a mixed stand are not touched upon. Taking this chapter as a type, it would appear that the author's object was to include only the fundamental facts which could be assimilated by the student readily, leaving him to pursue the subject further for other sources at his leisure.

Chapter VII, on "Damages," is even more brief and casual, comprising but 7 pages, one of which is devoted to an analysis of a crude but simple method of determining the damage to a young stand on the basis of mean annual value increment multiplied by age of stand. A similar plan is being discussed by District 2 at present. Briefly, if a stand at 100 years is worth $100 per acre, an acre burned at 20 years of age would be valued at 20 × 1.00, or $20.00. Roth sums this up by saying: "It is evident that this method of computing the value of the stand lacks analysis and must always be defective, especially with young stands, where the computation of regular cost value is much more satisfactory."

In "Taxation of Forests," chapter VIII, the author by statistics brings out the fact that European forest taxation is seldom equivalent to over 6 per cent of stumpage value or income. This chapter is largely devoted to the economics of forest taxation and tax reform and contains a brief discussion of the Connecticut and Massachusetts laws. The basis is given for the determination of Massachusetts' 6 per cent stumpage tax, but the land tax is stated erroneously as being a "flat rate"; the principle used by Massachusetts is to tax the land at the current rate of taxation applied to other property. The author adopts the "income" basis for timber taxation, and considers the total of taxes plus interest for the rotation as indicating the per cent of stumpage value which should be taken in the case of intermittent yields. He advises the use of a high rate of interest for capitalizing the value of the income for taxation, in contrast to the low rate used in other calculations, on the ground that the owner bears all the risk and the State none.

The same basis—that is, income—is advocated for forests yielding annual income, and it is noted as self-evident that such forests will yield more taxes than the former class. This latter case is in reality an admission of the principle of forest rent as applied to taxation, although in the discussion of soil values the "selection" or regulated forest is claimed to represent the same total expenditure and compound interest as the even-aged stand, and might on this basis be taxed at the lower rate—that is, on soil value or its proportional per cent of stumpage value.

The final conclusions are that a yield tax is the best present reform, but that this will eventually gravitate back to a property tax based upon income. The recommendations for simple tax laws are worthy of especial consideration. They consist of the adoption of a uniform plan of taxing land at 5-mill rate on its actual value, and levying a yield tax on timber graduated up to 6 per cent, omitting woodlots as part of farms and exempting forest plantations for 25 years. A study of the Connecticut and other laws has led the reviewer to the same conclusions, namely, that a low tax on flexible land values and a low yield tax on stumpage, the system to be compulsory by towns, counties, or States, and without requiring the practice of forestry, is the next move in tax reform.

In chapter IX European fire insurance is reviewed, showing that the rates charged for private fire insurance abroad approximate 1.00 per cent on value, while the fire losses on State forests amount to but .0117 per cent for Prussia and .0134 per cent for Austria. Two insurance companies cited charged respectively $30 and $57 on each $1,000 of gross income, while the fire losses for Prussia were but $1.90 for $1,000 of income and for Bavaria $0.66. The practical difficulties of fire insurance in this country, chiefly concerning the valuation of fire damage, are pointed out.

In the final chapter, X, "The Right Use of Land" is chosen as the caption, covering the comparison of lands for agriculture and forestry. This question, as in the case of taxes, is discussed broadly for its economic setting, and statistics cited to show the percentage of area in various groups of States which may be classed as agricultural, forest, and waste. For the United States these are respectively 25 per cent, 26 per cent, and 49 per cent—in other words, nearly one-half of our territory is not even fit for timber production. By citing average prices for farm crops, the author demonstrates the superiority of forestry as a use for much poor soil. The interrelations of agriculture and forestry in promoting stability in labor conditions, home markets for farm products, and the support of transportation are set forth. This great field of economics, so little understood by new communities, offers tremendous opportunities to the forester as a basis for propaganda.

The appendix contains money yield tables for spruce and pine, oak and beech, from Schwappach, and normal yield tables for the same species. The tables of compound interest give the value of $1.0p^n$ from 1 to 10 per cent and for each tenth of 1 per cent intervening. The student may determine the values of $\frac{1}{1.0p^n}$ for himself. Thirty-seven problems are given for use in teaching.

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Finland's State Forests [1]

Finland, with a total forest area variously estimated at from one-half to two-thirds of its total land area, probably has a larger proportion of forest area than any other country in the world. Of this forest area considerably more than half is owned by the State. According to recently published official statistics, the area of these State forests in 1912 was as follows:

	Per cent.	Area (acres).
Cultivated lands	.56	174,000
Productive (dry) forest land	42.67	13,295,000
Unreclaimable swamp and marsh land	53.00	16,516,000
Water	3.77	1,176,000
	100.00	31,161,000

[1] "Finsk Skogsstatistik," by J. T. Blomquist in Skogsvårdsföreningens Tidskrift, July, 1915.

The small per cent of cultivated land and the large per cent of unreclaimable swamp and marsh land are particularly noteworthy. Of the total area of 31,000,000 acres included in the State forests, only a little more than two-fifths consists of productive forest land, which is even less than the proportion of productive forest lands in the National Forests of the United States. The bulk of the State forests are in the northern part of Finland and consist largely of protection forests interspersed with extensive areas of barren land. In the very northernmost part of the country nearly 8,000,000 acres have been set apart as protection forest, of which only 3 per cent is private land. Since the management of this protection forest must be particularly careful and financial returns correspondingly low, this district is left out of consideration in calculations of future incomes from the State forests.

The State forests consist mainly of land which has always belonged to the government, or in earlier times to the Crown. The policy of increasing this area by purchase was, however, adopted in 1874, and considerable areas were secured up to 1895, when the policy was abandoned. In 1906 purchases by the State were resumed, and from then to 1912 39,809 acres were purchased for $204,025 ($5.13 per acre). During recent years an annual appropriation of about $39,600 has been made for this purpose. While these purchases are small in comparison with the total area of the State forests, they are nevertheless significant as an indication of the well-established policy of Finland not only to retain forest lands already in the possession of the State, but to add to these as circumstances make it possible.

As would naturally be expected in a country lying as far north as Finland, the individual trees are comparatively small and slow-growing, with only a few large trees per acre. Reconnaissance estimates show that on the State forests there are approximately 141,000,000 trees of merchantable size, divided into two classes:

10 to 12 inches d. b. h.[2]	82,629,004 trees
Over 12 inches d. b. h.	58,781,445 trees

The fact that this apparently large number of trees does not indicate a heavy stand is evident, when it is remembered that these represent only 10.6 trees per acre of productive forest land, or 4.8 trees per acre of total forest-bearing land. The stand per acre of productive forest land varies from 486 cubic feet in parts of the extreme north to 2,002 cubic feet in the south. In general, the stand averages about 715 cubic feet per acre

[2] D. b. h. in Europe is taken at 4.25 feet, rather than at 4.5 feet, as in this country.

in northern Finland and twice as much, or 1,430 cubic feet per acre, in southern Finland. It is interesting to note that in some cases the stand on dry forest land is considerably more than on unreclaimable swamp land. This is particularly the case with Norway spruce, and is due to the fact that large areas of spruce swamp still remain untouched as a result of poor markets for the smaller-sized material.

Reconnaissance data are usually collected by special crews, which count the trees and estimate the stand by various age classes and forest types. Sample plots and volume and growth tables are used in determining both present stand and future growth. The amount of the cut is determined on the basis of growth calculation, although it is also often influenced decisively by overmaturity, market, soil, etc. The mapping of the forests is done either at the same time as the estimating or by a separate survey. The reconnaissance work is carried on continuously, and it is aimed to have a revised estimate for each area prepared every ten years. In the year 1912 $65,620 was spent on such reconnaissance work.

The timber-sale business in the Finnish State forests is well developed. In 1912 forest products to the value of $2,495,200 were sold, of which 85 per cent was saw timber. This is a marked increase over the timber-sale receipts of $1,401,000 in 1905, which at that time was reported to be the maximum ever received in one year. The total amount of the cut in 1912 was 86,202,000 cubic feet, or 6.43 cubic feet per acre of productive forest land. This is believed to be considerably less than the annual growth. The highest cut was, as might be expected, in the southern part of the country, where on one forest it averaged 64.35 cubic feet per acre. In comparison with the United States, it is interesting to note that the amount cut under timber sales on the National Forests in this country for the same year amounted to 431,492,000 board feet (possibly 86,300,000 cubic feet[3]) and yielded $942,819. It should be remembered, however, that in the United States these figures refer to stumpage values only, while in Finland most of the timber is cut by the government and sold in the form of logs.

The bulk of the sales are carried on by general auctions, at which the timber is disposed of to the highest bidder above a certain minimum price. In 1912 2,465,430 saw-timber trees (10 inches and over in diameter breast high) were offered for sale at such auctions, together with considerable tie material and firewood. The trees are ordinarily sold in the form of single logs, and the average price per log was 83 cents, varying from 12 cents to $1.93. Because of low bids about 630,165 stems were left unsold. Of the material put up at auction, 76.6 per cent was

[3] Assuming that 5 board feet equal 1 cubic foot.

Scotch pine and 23.4 Norway spruce, divided into the following diameter classes:

10 to 12 inches d. b. h.	20.9 per cent
12 to 14 inches d. b. h.	45.8 per cent
14 to 16 inches d. b. h.	19.8 per cent
Over 16 inches d. b. h.	13.5 per cent

Considerable smaller saw timber, tie material, and firewood are also offered for sale at smaller local auctions. In 1912, for instance, products valued at $229,724 were disposed of in this way. These auctions are constantly increasing in popularity and importance, as is seen from the fact that while they were held in only three of the State forests in 1904 they were held in 45 in 1912. The chief purchasers at such auctions are now sawmills, which some ten years ago had practically no interest in them.

Very recently steps have been taken to increase the utilization of the more remote forests by the sale of unusually large quantities of timber. This is particularly interesting as offering a parallel to the large timber sales in the more remote portions of the National Forests of the United States, as, for example, the comparatively recent sale of 800,000,000 board feet in central California.

In addition to timber sales 7,368,063 cubic feet of timber, valued at $67,626, were disposed of without charge to settlers and forest officers in the State forests.

For so large and comparatively unsettled a forest area the extent of the fire damage is remarkably small. In 1912 only 991 acres were burned over at a loss of $11,945 ($12.05 per acre). This showing is particularly remarkable, when it is remembered that it is not so many years since reckless burning of the forests was the rule, and fires were frequently set in order to clear patches of land which were cultivated for a few years and then abandoned. Trespass occurred in 277 cases, but amounted to only $1,732.

The State itself operates three sawmills. These at first were intended only for the utilization of such forest products as did not find purchasers in the general market and for the procuring of firewood for the State railways. They have, however, developed considerably, until now they are a source of more or less export material. In 1912, for instance, 2,000 standards were produced by these mills for export, and considerably more in 1914. In addition to making possible the utilization of the more distant forests, these mills have proved of decided advantage in giving the government a clearer insight into conditions in the international timber market and a better grasp on the sawmill industry.

The total income from the State forests in 1912 was $2,726,853 and

the net income $1,692,039. This amounts to a net income of 12.7 cents per acre for productive forest land, and is certainly a creditable showing, when the poor growing conditions and comparative inaccessibility of much of the State forest areas are considered.

In 1915 the personnel of the State forest service was as follows:

General administration (including copyists, map drawers, etc.)	25
District foresters, or district inspectors (Överforstmästare)	10
Forest supervisors (Forstmästare)	95
Forest fiscal agents (Forstkassörer)	64
Forest examiners and forest assistants (Skolade arbetsledare)	70 to 80
Forest guards (Skogvaktare)	940 to 950
For reconnaissance work (Forsttaxatorer-revisorer)	20
For drainage work	4
For sawmills	6
For ranger schools	9
For crown lands	13

From 180 to 200 trained foresters are regularly employed, in addition to which there are a varying number of temporary appointments in the different forests. Technical forestry is now taught at the University at Helsingfors, where the course covers from three to four years.

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FOREST PATHOLOGY IN FOREST REGULATION [1]

This is a most unusual bulletin, emanating as it does from the Bureau of Plant Industry and yet dealing with a highly technical branch of forestry—forest regulation or, as some prefer to call it, forest organization. The author is primarily a pathologist, yet he has a clear, strong grasp of technical forestry; rarely does he make a faux pas. His position, as a pathologist, in relation to forestry is well stated: "Forestry is not interested primarily in the morphology and life history of a given heartwood-destroying fungus. Such studies, though indispensable and of the highest value, belong to an altogether different realm of science. The forester thinks in terms of trees, not of fungi; he concentrates on timber species to be protected or utilized, not on parasitic organisms, however interesting they may be from a mycological point of view. If forest pathology is ever to be of any value to practical forestry, all work and all conclu-

[1] U. S. Department of Agriculture Bulletin No. 275. Contribution from the Bureau of Plant Industry. Professional paper by E. P. Meinecke, Forest Pathologist.

sions must be focused on the tree, the species, as a producer of timber values and as a member of the forest community."

The author starts with a general review of regulation of the yield as it affects and is affected by forest pathology. He then goes on to give a concrete example—the white fir (*Abies concolor*)—setting forth in detail the methods of investigation and his interpretation of the data. Finally, he states his conclusions and what he conceives the outlook for the future to be.

The first part contains nothing new, but is a clear statement of various phases of forest management, such as working plans, rotation, cutting cycle, and the like, with reference to forest pathology. For the most part this is good law—"Aye, marry, 'tis crowner's 'quest law!" but the author is a little hazy on some points. For example, under cutting cycle he says: "If present economic conditions should prevail in the next 50 years—that is, if the demand for timber should continue to fall far short of the actual annual increment—it would hardly pay a lumbering concern of the future to extend its operations to cut-over areas before 50 to 60 years had elapsed. Even then it seems doubtful whether the amount of timber contained in the few overholders left as seed trees and in individuals at or just below the diameter limit established in a first cutting would prove attractive to purchasers of the future, provided always no change in the lumber market should take place. The diameter limit now fixed on many national forests may be said to be about 12 inches, varying somewhat with the species and local conditions. Few trees below this diameter will reach such dimensions in 50 years as to form a merchantable stand, judged by our standards of today." Two paragraphs further on he states: "How much time this first culling may consume we have no means of telling. It should be remembered, however, that the system naturally presenting itself is that of selection cutting, and although there is a decided tendency toward heavier marking approaching clean cutting, this latter should be taken cum grano salis. Actually, the reproduction left includes all individuals up to and sometimes beyond 12 inches diameter breast high—that is, trees that have reached a considerable age and that in 50 years will have grown to what would be classed in European forestry as veterans." These two statements do not seem to agree.

When he gets on the subject of cumulative risk, condition of timber stock, and total loss, the author is on familiar and surer ground. The following excerpts bear this out: "Condition of the timber we hope to raise for the future, in the definition as given above,[2] has a strong bearing

[2] "If 'condition' is defined as a state of health, not only as far as thriftiness of growth is concerned, but also with special regard to degree of merchantability as influenced by decay, the condition factor becomes a subject of pathological study."

on the possible regulation of the yield. There can be no sense in figuring cutting cycles or rotation for future generations to follow unless we assume that our successors will find the area we have cut over covered with a stand not only apparently but really merchantable; in other words, with timber that is not rendered valueless by decay. The most ingenious speculation as to future yield is without any value whatever unless we have some way of figuring how long the steadily increasing but admittedly perishable timber stock can be left in the forest before it is liable to destruction by fungi.

"The most important problem before us, therefore, is the determination in definite values of the condition of timber stock, present and future."

"Here is the clue to the proper silvicultural valuation of cutting cycles or rotation on a pathological basis. The time at which a tree or a stand is to be cut may range from a comparatively low age to the age of maximum production of lumber, according to the special needs the forester has in view; but the upper limit of this range should not lie beyond the period at which the gain from increment is offset by loss from decay, irrespective of the ideal amount of timber a sound tree or stand might produce under favorable conditions."

"Since we may expect that cutting during the period of transition will practically eliminate all those trees which by their combination of suppression and wounding become subject to early decay (critical age), the age of decline forms the basis for what might be termed the "pathological rotation," for want of a better expression. It does not indicate that a given species should most advantageously be cut in regular intervals expressed by the pathological-rotation age, but that it should not be cut at a higher age. It is really a factor limiting the rotation and therefore also the cutting cycle."

"That the value of lumber grades is bound to play a far more important rôle in the future than at present, with regard to rotation, is a foregone conclusion."

These are the ideas which the author proceeds to elaborate in his example of the white fir. His field methods are carefully worked out and will repay study. Exception may be taken to the way of determining the age of the tree which, in the author's words, "is generally counted at a stump height of 18 inches, and, since for all purposes of management we have to deal with the standing tree where diameter is the only indicator of age, it is of little importance whether the age counted is absolute, within narrow limits, as long as all figures are directly comparable with each other. Moreover, in practice it is impossible to have all trees cut at exactly 18 inches. With the greatest of care, the stump height will vary.

It is an easy matter, where desired, to add a number of years corresponding to stump height as soon as reliable figures, which now are lacking, are obtainable." This is scarcely up to the standard of forest mensuration.

Coming now to the specific study of white fir, the author states: "By far the most serious danger to white fir throughout its range comes from *Echinodontium tinctorium* Ellis and Ev. This fungus seems to be particularly adapted to *Abies concolor* and does not appear on many species.

In California it is, though not very often, found on *Abies magnifica shastensis* and also rarely on Douglas fir. This fungus must therefore be considered as the chief fungus enemy of white fir."

The author shows his good sense by paying greatest heed to the practical phases of his problem: "But in practical forestry we do not seek an answer to the question of the earliest age at which a tree might become infected, interesting as this is from a mycological point of view, but, rather, from what age may we with reasonable certainty assume that serious decay becomes so prevalent as to distinctly impair the merchantability of the timber."

For the purposes of this review, the results of the white-fir study constitute the chief interest. The following quotations are taken from the interpretation of the white-fir data: "While decay in the broadest sense of the word may show in trees 60 years old and perhaps younger, the critical age of white fir with regard to more serious decay appears to lie at about 130 years, at least for the region investigated, taking into account that we have to deal here with a practically virgin stand grown up under the cumulative risk from suppression, frost, lightning, and the other factors of influence."

"We find, further, that up to about 150 (148) years in badly wounded but dominant thrifty trees the decay is either not very far advanced in degree, if in extent, or that the wounding is of quite extraordinarily severe character."

"The first (of three critical stages) is the 'age of infection,' which may be at 60 years or below. Here the infection rarely leads to more than negligible decay unless the tree is handicapped by quite unusually severe conditions, such as very large old wounds.

"The second, at about 130 years, which we may term the 'critical age,' marks the point after which a combination of pronounced suppression and heavy wounding generally results in distinct decay. This combination of deleterious factors is one commonly found in virgin forests. Wounding alone is not sufficient to unfavorably counteract thriftiness of growth.

"Another change comes about at 150 years, when even dominant trees become subject to extensive and intensive decay. For thrifty but wounded white fir, such as we may expect to raise under management, this 'age of decline' is, therefore, the factor which will influence the rotation and cutting cycles of the species, since for many years to come the risk of inoculation will be more or less the same. There will be fires as long as there are lightning storms. Wounding through lightning and frost are inevitable. Besides, many trees are already wounded."

"Where decay is traced to a combination of two factors, each factor is shown separately. The means of entrance of the fungus-causing decay are thus shown to be as follows: Fire, 48; frost, 25; lightning, 23; other causes (including knots, girdling, etc.), 13; total, 109.

"These 109 wounds (including knots, etc.) led to 97 cull cases. Out of 109, only 13 were other than wounds from fire, frost, and lightning, and 11 of the 109 cases of decay were the effect of a combination of two of the causes named. Fire has by far the greater share; frost and lightning are second, but the preponderance of fire and frost over lightning is greater than would appear, since they are far more serious with respect to causing decay. If ratings are given, more or less arbitrarily, but yet in keeping with our field observations, to the various causes of wounds in the order of their importance with relation to damaging decay in white fir, taking injury from lightning (the least consequential) as the unit, we have: Fire, 3; frost, 4; lightning, 1; other causes (including knots, girdling, etc.), 3. Then, multiplying the figures for means of entrance by these relative ratings, we have: Fire, 144; frost, 100; lightning, 23; other causes, 39. These figures express the following facts: (1) Fire injury is not only numerically the strongest, but also commonly leads to considerable cull; (2) frost damage is less frequent (above all, less ubiquitous) than fire damage, because it appears only in typical frost belts or frost holes, but it carries decay over a much greater length of the bole; (3) lightning injury is fairly common, is also restricted to certain belts, and leads more often to superficial rot; (4) other factors are of importance as causes of damaging decay, but they are comparatively rare."

A typographical error occurs on page 48, where 106 should read 160.

The last part of this bulletin concerns itself with "Conclusions and Outlook." The author emphasizes the point that "the aim of the present study is not to lay down laws, but to show by means of one example the problems before us and the various steps leading up to a working method for the future establishment of laws which may—or may not—confirm the conclusions from this study, and to strongly advocate similar studies

on a larger scale. With this point plainly in view, but assuming that our conclusions are a step in the right direction, we may discuss their bearing on the silvicultural problems that are before us."

In regard to the care of virgin forests, the author speaks of fire wounds as follows: "*The sooner such fire-wounded trees, as well as all other undesirable individuals, including all badly injured, diseased, and misshapen ones, can be eliminated from the forest, the better.*" This is a vital point in marking, which is seldom heeded as carefully as it should be. The italics are the reviewer's; however, the author states the same idea in the following excellent catch-phrase: "Sanitation of the forest must be the first and fundamental step in forest regulation."

Every forester will heartily indorse the plan to eliminate guesswork in determining the actual cull per cent from decay. "It is the constant aim of forest pathology to reduce this guesswork to actual and concrete figures. It is intended to repeat similar studies throughout the range of white fir and later also on other species in the order of their importance, and finally to establish broad zones of equal pathological conditions, in which the rot percentage may be given in definite figures."

The author is evidently a thorough scientist and a man of erudition. His style is good, but would be better if he did not use "we," "ours," etc., so constantly. One also gets the impression, in reading this bulletin, that all forestry in America is confined to the National Forests. That the Federal Forest Service leads the profession no one will deny, but there are also other laborers in the vineyard.

Altogether this bulletin is a notable addition to forestry literature. It is a good example of what the author means, when he says: "The lessons taught us by earlier forest history in Europe, the adaptation rather than adoption of European principles to American conditions, and the development of new principles to suit our own special needs are therefore the means by which forestry in the United States will finally solve the silvicultural problems before it at the present day."

A. B. Recknagel.

Ithaca, N. Y., May, 1916.

SOCIETY AFFAIRS

The Proposed Membership Changes and the Ends Which They Will Accomplish

The division of the Society membership into junior and senior grades, proposed by Mr. Mason at the San Francisco meeting, in the paper which appears elsewhere in this number of the Proceedings, seems to the writer to combine items directly involving four distinct objects. No clear statement of these objects was made at the meeting. It is believed that the confusion which the discussion at the meeting developed can be materially cleared up by an analysis of these objects and their relation to the proposed measures.

The objects are:

1. To raise the standing of the Society; this having reference to the profession at large and, to a certain extent, to the public.
2. To extend the influence of the Society within the profession.
3. To provide a class of honor within the Society.
4. To provide machinery for carrying objects 1, 2, and 3 into effect.

I am not here discussing whether the objects named are all that the Society should try to accomplish. I want to show that they are involved in the proposals made and how they affect the value of the latter.

1. *Raising the standing of the Society.*—This object all members approve. The meat of the whole matter, however, lies in the statement of Dr. E. P. Meinecke at the San Francisco meeting, that the standing of a society is determined by its voting membership. Mr. Mason's proposal is to divide the membership without limiting the voting power. Such a division cannot accomplish the object under discussion because the standing of the Society will be left with the voting power, where it now is. To raise the standing of the Society, the governing or franchise-carrying membership must be restricted. The American Society of Civil Engineers has a division of its membership into junior and senior grades, of which the senior only has the franchise; and the membership of the senior division is jealously restricted to men whose individual standing is so high as to insure a high standing for the society. The high value which membership in that society carries in the eyes of the engineering profession is sufficient proof of the effectiveness of the method. The farther division of the senior grade in the engineering society into associate mem-

bers and members is not significant enough to have any value for the Society of American Foresters. The difficulty in applying such a scheme now, after the Society has been running for a number of years on a basis of universal suffrage, will be discussed under the heading of machinery for carrying out the main objects.

2. *Extension of the influence of the Society within the profession.*—This object has pretty general approval among the members. It is diametrically opposed in effect, however, to object number 1, and under a uniform membership the two are incapable of any complete simultaneous realization. In this dilemma originated the various segregated membership schemes. The writer believes, however, that Mr. Mason's plan, paradoxically enough, will fail to accomplish the second object because it fails to accomplish the first. The motives which impel men to join such a society are usually a mixture of the general good and private advantage. The latter divides into the direct advantage of participation in the meetings, discussions, and social events of the Society and receiving its publications and the indirect advantage of increased personal prestige which such membership may confer. The history of the Society of American Foresters demonstrates pretty clearly, however it could be wished otherwise, first, that the last-named motive outweighs all the rest with a majority of the profession; second, that any attempt to bring more members into the Society by letting down the admission requirements will soon counteract itself, and will alienate more desirable members than it adds by lowering the standing of the Society, and thus diminishing its most highly prized contribution to its members in prestige. For this reason Mr. Mason's proposal cannot materially or permanently increase the influence of the Society within the profession because it cannot increase its standing there. A division of the membership, with a limitation of the franchise to the senior grade, will accomplish the two otherwise unreconcilable objects, raising the standing of the Society because of the restriction and adding steadily to its junior membership (which is the most vital way of extending its influence), in spite of denying the vote to that membership—in fact, because of so doing—since this gives the senior membership real value—worth a man's beginning as a junior in the hope of some day attaining to.

The attainment of both of the two objects which have been discussed thus rests upon a state of mind. And there seems to be a certain psychological value, also, in restricting the name "member," as does the American Society of Civil Engineers, to the highest group only of its membership. The Society of American Foresters can appropriate this not inconsiderable psychological aid in attaining its objects by designating the

senior, or franchise, group of its membership (assuming a limited franchise segregation) as "members" only, refraining from the use of such terms as "senior members," etc., except very informally and unofficially, and never designating the junior members without that qualifying term.

3. *Particular distinction for our most honored members is the legitimate object of a fellowship class.*—It is not clear that there was any such understanding of the term by Mr. Mason or others who used it at the San Francisco meeting. But the term is so used by the scientific societies, such as the American Association for the Advancement of Science, and by most of the better technical societies. At any rate, it is never synonymous, so far as the writer knows, with such a class as senior membership, as it was loosely used by Mr. Mason. The Society of American Foresters could well avoid in this instance the usage of the American Society of Civil Engineers, whose "fellows" are those who dig up a little more cash than the common herd for the coffers of the society. For the latter "sustaining members" is a much more appropriate and usual designation. The writer believes that the creation of a fellowship class, as first defined, would be a very appropriate tribute from the Society to its few members worthy of such a special honor, and that it would be comparatively easy to avoid abuse by confining its bestowal strictly to those whose achievements are so conspicuous as to place them head and shoulders above their fellow-members in the profession.

4. *Machinery.*—The writer does not believe that we can get away, or that it is necessary to get away, from achievement as a measure of value. The trouble in the past has been that, with a uniform membership, as the size of the membership increased it became impossible for a central committee on admissions to have the necessary personal knowledge of the candidates for admission; and when, as a means of escape, the committee took the recommendation of individual members or groups of members, as it must to all intents and purposes under the present system, the result was serious inconsistency between the merits of those elected on the recommendation of different members. Two ways of escape have been advocated: First, a more detailed definition of the degree of achievement which shall be accepted for membership; and, second, when the impracticability of the first became apparent, the abandonment of achievement altogether as a criterion. None of the advocates of the latter, however, have proposed anything constructively workable to replace achievement. Under a segregated membership, achievement can be made a workable measure of value by vesting the approval of candidates for junior membership in the local sections of the Society, and that for full or senior membership in the parent Society, as proposed by Mr. Mason at the San

Francisco meeting. The Section committee will be in a position to obtain the necessary information with regard to the less widely known men who will be candidates for junior membership, while their judgments at the same time will have more stability and consistency than do those resting on individual recommendation. On the other hand, the achievement which is to be accepted for senior membership will be both easier of definition and so high as to make the candidates widely enough known to enable the central committee to pass satisfactory judgment upon them.

Notwithstanding its advantages, many members feel that the adoption of a segregated membership, with the franchise limited to the senior grade, is impracticable for this Society, because we cannot justly take away from any the franchise which all now have in common. Difficulties will doubtless be encountered, but it does not appear so sure that any inalienable rights will necessarily be violated. The most feasible method, although not entirely satisfactory on the score of results, the writer believes to be a division on the basis of age of membership, making all full members who were admitted before a specified date, say 1912 or 1910, and all those juniors who were admitted since the beginning of the chosen year. It is a fair assumption, by and large, that the younger members have not gone so far as the older ones in achievement; and while a few would doubtless be left seniors whose achievement does not warrant it, as well as some made juniors who merit more, the errors in the case of the latter, at least, are easily rectified, and the scheme will be a long step in advance, with substantial justice. Whether an attempt to evaluate the whole membership will gain any greater justice is very doubtful; it will certainly involve the Society in more wide-spread jealousies and hard feeling.

If limiting the franchise within the present membership is not approved, the same ultimate result can be accomplished by leaving all the present members as seniors and applying the junior membership to future admissions only. By thus raising the standard of those who were admitted to full membership in the future, the relative weight of the present unfit members would gradually diminish. But the speed of the accomplishment of this result would hardly give membership in the Society any overwhelming attraction to those at present outside the fold.

Two important suggestions made at the San Francisco meeting were, first, that of Dr. Meinecke, that achievement as a measure of eligibility for membership should rest on originality; second, that of Mr. Du Bois, that the benefit of such originality should not be denied to a man who makes a real achievement in real forestry because he may be a ranger without a forestry-school sheepskin. And to the latter, it might be added,

neither should recognition be denied to a professional forester because he made his achievement in some work difficult to classify in the list of accepted activities, as stated in the recent revision of the constitution (which might not inconceivably happen in a great organization like the Forest Service); nor should membership in the Society be extended for achievement, however brilliant, in lines involving no essential forestry, by a man without technical forestry training, because the achievement was made in the course of work in a forestry organization.

To sum up, the writer believes limitation of the voting power to the senior group to be so essential to the accomplishment of the results desired from a membership segregation that it should be a part of any scheme whatever which is adopted. With a membership segregation, achievement becomes a workable measure of eligibility and should be retained, certainly until something concretely better is forthcoming. Achievement should be based on originality, and should be judged with discretion and elasticity, securing uniformity of judgment through full knowledge and a small number of stable tribunals, rather than through a microscopic definition of so many-sided a thing as achievement. To accomplish this end, the best method is to vest the approval of junior members in the appropriate committees of the several sections of the Society and that of members in the committee of the parent society. The term "fellows" should be used to designate a class of special honor, without reference to the character or qualifications of the regular membership or its classes. The establishment of a carefully limited class of fellows on this basis would be an appropriate and desirable step on the part of the Society.

C. L. Hill.

Sierra National Forest.

A number of informal talks were given during the winter before the Portland Section. The meeting on November 22 was addressed by Mr. E. T. Allen. On December 17 the meeting was given over to a discussion of the subject of education in forestry, and was addressed by Professor Winkenwerder of the University of Washington and Professor Peavy of the Oregon Agricultural College.

On March 8 Mr. J. V. Hofmann, director of the Wind River Experiment Station, described the problems of the Experiment Station with special reference to new discoveries concerning natural reproduction of Douglas fir and its associated species. The fact that the greater part of reproduction following burns is due to seed stored in the forest floor

previous to the fire was very clearly shown. It was also demonstrated that in most instances it is not the first fire, but subsequent ones, which cause denuded areas. When a second fire occurs before the stand is of good seeding age, the result is invariably a denuded area. This emphasizes the value of reproduction coming in after a fire and shows the necessity of protection from fire.

The Executive Committee has approved the establishment of a local section of the Society, to be known as the Denver Section of the Society of American Foresters at Denver.

The committee appointed by the President to select a pin or badge for the Society has finally decided upon a shield as the most dignified symbol. Below is a reproduction of the symbol in exact size. The white part of the badge is in gold and the black part is in dark-green enamel. The shield, bearing the name of the Society and the year when it was organized, is now the *official* symbol of the Society. The firm of J. F. Newman, 11 John street, New York City, with stores also in Chicago and San Francisco, is now prepared to accept orders for the Society of American Foresters' pin at $3.25 each. Orders should be placed through the Secretary of the Society.

A vacancy having been created in the office of Secretary of the Society of American Foresters through the resignation of Findley Burns, the Executive Committee has designated C. R. Tillotson to fill this position during the remainder of the unexpired term of Mr. Burns.

During the winter of 1915-1916 the following subjects were discussed at the meeting of the Missoula Section:

November 29—Qualitative and quantitative standards for handling a ranger district.—F. A. Silcox.

December 13—Progress in methods of cutting white pine.—C. K. McHarg.

January 10—Forest Service trail standards.—F. G. Clark.

January 24—National Forests and the taxation problem.—Elers Koch.

February 7—The Government's business of selling stumpage.—J. F. Preston.

February 21—Principles, methods, and results of a fire survey.—J. B. Somers.

March 6—Silviculture from the logger's standpoint.—Dorr Skeels.

March 20—The geological resources of Montana.—F. R. Ingalsbe.

April 3—Progress of reforestation.—E. F. White.

Members of the Society of American Foresters have been invited to participate in the annual Out Meeting of the Pennsylvania Forestry Association, to be held the last week in June, in the city of Reading, Pa. During this meeting a number of places in the neighborhood of Reading where interesting forestry operations are in progress will be visited.

Charles Albert Davis

Dr. Charles Albert Davis, geologist in the Bureau of Mines and an associate member of the Society of American Foresters, died on April 9, 1916, in his fifty-fifth year.

Dr. Davis was a type of the old school scientist, who united a broad and thorough education with a capacity for keen observation and a natural aptitude for scientific work in many different directions. It was his versatility and broad outlook which made him available, at a time when the need was great, as the first instructor in forestry at the University of Michigan. He was best known as an authority on peat; among his publications, however, there are a number on forestry subjects, and his maps of the forest types and swamp areas of Michigan are among the best that have been prepared for any State.

His loss will be felt especially by those of the members of the Society who knew him as an instructor and a friend.

Proceedings
of the
Society of American Foresters

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Vol. XI JULY 1916 No. 3

CONTENTS

Recreational Use of Public Forests in New England. Allen Chamberlain..... 271
The Use of the New York State Forests for Public Recreation.....George D. Pratt..... 281
Use of the Southern Appalachian Forests for Recreation.....J. S. Holmes..... 286
Use of the National Forests of the West for Public Recreation.....E. A. Sherman..... 293
Hylobius Pales as a Factor in the Reproduction of Conifers in New England..... E. E. Carter..... 297
The Growing Stock as a Criterion of Normality.....A. B. Recknagel..... 308
Hewn-Tie Versus Saw-Timber Rotations.....Clarence F. Korstian..... 315
Forest Taxation as a Factor in Forest Management. G. W. Hutton and E. E. Harpham..... 330
Scientific Notes and Comments:
A Cheap Fertilizer for White Pine Seedings....W. D. Clark..... 336
Another Caliper.....S. T. Dana..... 337
Notes on French Forestry in Africa and Corsica. T. S. Woolsey, Jr..... 338
A Course in Methods of Field Experimentation..... 345
Reviews:
The Forest Service Reports on Wood-Using Industries of the States.....Dr. Roland M. Harper..... 346
Significance of Mycorrhizae in the Life of Trees. E. R. Hodson..... 353
Forest Legislation in America Prior to March 4, 1789.....John D. Guthrie..... 355
Criticism of French Forestry.....T. S. Woolsey, Jr..... 358
Silviculture for British India.....S. T. Dana..... 359
Society Affairs..... 366

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The Proceedings of the Society of American Foresters appears quarterly—in January, April, July, and October. It contains papers delivered before the Society at its regular meetings, and original contributions by both members and non-members of the Society.

Papers that have already appeared elsewhere will not be accepted for publication. Simultaneous publication in another journal will not be agreed to.

Manuscripts may be sent to any member of the Editorial Board and should be clearly typewritten and in suitable form for printing without essential changes. Footnote references should be complete, including year of publication.

The Editors reserve the privilege of returning to the author for revision approved manuscripts and illustrations which are not in proper finished form for the printer, or, if the author so desires, the Editors will have the manuscripts and drawings prepared and charge the author the cost of this work.

Illustrations will be used only when absolutely necessary and will be confined largely to text figures or diagrams of simple character. The Editors, at their discretion, may call upon an author to defray the cost of his illustrations.

Since the membership of the Society is scattered throughout the United States and the nature of the field work of its members takes them often to remote and inaccessible places, in order to secure prompt publication no proof will be sent to authors unless requested. They are urged, therefore, to submit their manuscripts in final form and the Editors will exercise care in seeing that copy is followed.

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Proceedings
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Vol. XI JULY 1916 No. 3

RECREATIONAL USE OF PUBLIC FORESTS IN NEW ENGLAND

By Allen Chamberlain,

President of the Appalachian Mountain Club, Boston, Mass.

It is most gratifying to note that the foresters of the country are showing an increasing interest in the recreational possibilities of the public forests. It is in no way surprising that they should, for I am inclined to the belief that there is hardly a man in the profession who was not primarily attracted to his calling because of an inherent love of the deep woods and the rugged mountains. Will any forester say that it was the commercial value of sawn lumber that first turned his thoughts toward the woods for a livelihood? A consideration of the economic possibilities clinched the matter in his mind, beyond doubt, but the lure of a life in the "merry green wood" probably furnished the initial inspiration. Such men, then, would be among the first to appreciate the recreational value of a forest over which they had professional control.

It is fortunate, as it seems to me, that your Society is giving this subject consideration at this time, for public interest in such forms of outdoor vacationing and holiday-making as are afforded by the public forests is increasing, powerfully stimulated by suggestive writings in newspapers and magazines, by excellent books, even, and further encouraged by mountaineering clubs and the Boy Scouts. The public is already prepared to use these forests in this way. More than a million and a half people, it is officially stated, now resort to the National Forests alone every year on pleasure bent, and it is perfectly apparent that this is but the advance skirmish line of the vast armies that sooner or later will

follow on. The people but await the increased opportunity. This growing public demand imposes a new duty upon the administration of the forests, and likewise a problem of some delicacy in determining how to meet the situation adequately, and without unnecessarily dislocating the other important interests to which the forests are primarily devoted.

Unless this problem is squarely met and solved in the near future by the foresters, there is grave danger that the public, acting under a short-sighted and impatient impulse to get what it wants and when it wants it, may seek to solve it to the distinct disadvantage of what are undoubtedly the primary purposes of the forests—their economic uses. Signs of impatience are already evident. What other meaning can be ascribed to the increasing number of Congressional bills for the creation of National Parks, most of which cover areas now within National Forests? This applies with equal force to the public forests under State and municipal control. The tendency is being manifested in Massachusetts in a somewhat different form. There the word "park" has come to carry the implication of heavy taxes, and the legislature is consequently shy of all such proposals today. State legislators are sensitive to public pressure, however, and the insistent demand for more "reservations" (they dare not use the word "park") at the expense of the Commonwealth is now met by the proposal that the desired areas shall be called State forests. This is a willful perversion, of course, for the tracts thus promoted are often of small value for forestry purposes, or, if adapted to timber growing, there is danger that the greater public interest in the esthetic phase would preclude any considerable utilization of the resources. Hence Massachusetts is threatened with a confusion of these two important issues, both of which need to be met. If allowed to merge on this false basis, the pressure for the too rapid acquisition of non-revenue-producing reservations, primarily valuable for recreation, will shortly produce a reaction among the taxpayers, and that reaction will be likely to result in the downfall of the recently inaugurated policy of reclaiming wasted woodland under a system of genuine State forests.

So, too, in the matter of National Parks, I fear that the public, in its praiseworthy eagerness to preserve as much native wild scenery as possible for the inspiration and enjoyment of present and future generations, may be led to create parks out of country that will quite as well serve their ends as forests if intelligently handled. In traveling about the country and in talking with people about these matters, it has become apparent to me that the distinction between National Parks and National Forests is not generally appreciated. Particularly surprising is the discovery that the people of the public land States, where are located most of the

National Parks and National Forests, do not seem to sense the essential difference.

Parks unquestionably have their place as well as forests; but is it not time to emphasize the difference? A well-ordered forest, under skillful management, is a beautiful object; but is it not in the same class with structural architecture of good design? Good art is everywhere good to look upon, but all natural men crave at times an opportunity to associate with wild nature. We look to the great wild National Parks of the West to satisfy to the fullest extent this longing. At present the National Forests of the western mountains also cater to us in this in large measure, but as years go on conditions there will charge under the hand of the silviculturist. The present primitiveness will fade. It is unlikely that man's fondness for the wilderness will likewise pass. It seems more probable that it will increase as opportunities for indulging it narrow.

The nation can not afford to tie up and eliminate from use all the resources of every beautiful bit of landscape, important as is the influence of that beauty upon the lives of the people. Doubtless there are private interests that would be quite content to have more of the public timber resources eliminated, as far as may be, from the competitive market There are, on the other hand, regions—some large, some small—that are of such striking and unusual beauty, or of such scientific or historic interest, that they should unquestionably be classed as parks, and kept purely for the enjoyment of the public. The existing National Parks, with one or two unfortune minor exceptions, have been created from such territory. All will agree that such a world-famous piece of scenery as the Grand Canyon should be added to the list, and there may be other sections that are worthy of similar rank, but they need to be tested by a high standard before being thus honored. It is undoubtedly true that, as a friend of the National Parks lately has said, "there is enormous advertising in the very name of National Park. It spells supremacy. It is the guarantee of quality by the Congress of the United States." It therefore behooves Congress to protect that trade-mark by preserving it jealously for application to superlative subjects only.

The public can well afford to forego the revenues that might be derived from the commercial utilization of the resources of such parks, because of the equally important recreational and inspirational benefits involved. To avoid confusion as to the purposes and uses of the parks and the forests should be the aim of the friends of both. And the friends of one should be the friends of the other, for they need not be antagonistic interests. On the contrary, they should be complementary. One of the surest means for fending off the unjustifiable clamor for unnecessary

parks would seem to be found in the opening of the public forests to recreational use just as widely as economic conditions will allow.

New England is a region far removed from the best that the nation offers to its people in grand and primitive scenery. The bulk of New Englanders can never enjoy the parks and forests of the Western mountains. Happily that crowded little corner of the country is not wholly devoid of natural charms. There even remain some nooks and corners into which man's exploiting activities have not yet penetrated. Generally speaking, the public sentiment of that section is enthusiastically disposed toward the improvement of the forests. Under the Federal Government it is hoped that the White Mountains will be brought back to verdure and productiveness, and most of the States are doing similar work on a smaller scale themselves. Here and there municipalities are either buying land on which to develop forests, or are devoting to that end lands they already own, such as the surroundings of their water supplies. Our manufacturers who use lumber of native species appreciate keenly the economic necessity for this.

Is it the interest in the economics of the project, however, that leads the great majority of the people to support this public forestry at the expense of taxation? Primarily, I believe that this public support is 99/100ths per cent pure sentiment. People gladly accept the statement of those who pretend to know, that it is just plain good business for the community to go into this, and they accept it because it gives them hope that in this way they, as individuals, are to have their longings for forest playgrounds satisfied. They are thankful for any legitimate excuse that will bring these things to pass. It is a wholesome sentiment. and the economist and the forester should welcome it and encourage it as an aid toward the accomplishment of the other ends. To foster that sentiment should be one of the foremost duties of the authorities charged with the administration of these public forests. How can it be more happily aided than by making adequate provision for the most complete possible enjoyment of the forests by the people? By encouraging them to go to the forests their sentiment is more likely to broaden into an intelligent interest in them and in all their aspects.

Wherever the area is large enough to warrant it, the adoption and extension of the policy of the United States Forest Service, which protects and preserves selected sections in the National Forests for the perpetual enjoyment of visitors, will further tend to make friends for the forests. In the White Mountain National Forest, which must eventually cover many hundreds of thousands of acres, the segregation of selected scenic areas is easily a possibility, whereas in the relatively small State and

municipal forest units, such as are likely to be developed in New England, this will be more difficult. It is not impossible that in New England the recreational interest in some of the smaller forests will have to be regarded as an item of major importance, for the large and ever-increasing population must be provided with greater out-of-door opportunities. It is my own belief, however, that the foresters will develop in time a system of lumbering that will be adapted to such peculiar conditions, whereby the public may be enabled to eat its cake and have it, too.

Although New England is lacking in that spectacular form of scenery with which so much of the western country has been favored, and notwithstanding that its climate has been made the subject of many a jest, it manages to attract to its hills, lakes, and ocean shores thousands of people from other sections in vacation time. New England is already a popular summer playground for the people of a wide area. With the increase in motoring, and the constantly expanding popularity of camping, walking, and mountain-climbing as vacation pastimes, New England finds that its interior country is being as highly appreciated as its varied and picturesque sea front. Many of the more remote sections have been made more readily accessible by the motor car, and throughout the region the States are expending large sums in road improvements to stimulate this travel. To every one who goes vacationing by motor, however, there are hundreds who go afoot. Frequently the motorist himself uses his car to take him quickly to some trail or favorite camping spot. The lure of the wild is everywhere present, in all grades of society, and with both sexes and all ages.

Public provision will have to be made for this growing tendency, which will increase as certainly as the facilities for its pleasant indulgence are extended. The opportunities for broad roving in many parts of New England are being yearly restricted through a more rigid enforcement of the trespass laws, not only near the centers of large population, but in the wilder sections as well, especially where big lumber companies are the owners. In some sections the laws require the employment of a licensed guide by all non-residents who intend to camp, an expense that is wholly prohibitory for many. Naturally, therefore, the public looks forward with eagerness to the extension of the public forests as places where, under reasonable regulation, it may disport itself untrammelled by private rights and regardless of whether one is a citizen of that State or of any other.

At present New England's public forests and other reservations are neither numerous nor extensive. Save for the National Forest in the White Mountains, which is steadily widening its boundaries, there are but

a dozen public areas of a thousand or more acres where the camper can be accommodated. Rhode Island and Maine have thus far shown no inclination to establish State forests. The other four States of the group have, however, made promising beginnings in this direction, and all have, furthermore, acquired by gift or purchase several wild tracts of considerable extent that are regarded today not as commercial forests, but as recreation grounds pure and simple. Adding to these the reservations held by three or four associations in the public interest, also the municipal lands other than purely local parks of the Sunday promenade and moonlight spooning type, the four States of Connecticut, Massachusetts, New Hampshire, and Vermont are seen to have provided a nucleus for what will doubtless become one day a system of reservations linked up, it may be, by roadways and footpaths.

This idea of a linked-up system is not wholly a dream. It is actually in process of realization today largely through the activities of three energetic and public-spirited walking clubs. For forty years the Appalachian Mountain Club has been engaged in making the White Mountains accessible to the walking public by a comprehensive system of trails, now more than 200 miles in extent, and it has in contemplation an extension from the Presidential group to the Connecticut lakes and the Canadian border. Within the past few years two other clubs have undertaken similar work. The Dartmouth (College) Outing Club has built sections of trail linking up existing stretches of highway and wood-road leading from Hanover, in the Connecticut River valley, fifty miles across country to the White Mountains, there to connect with the Appalachian routes. It is only within the past five years that the Green Mountain Club came on the scene with its ambitious plan to lay a footway that might eventually connect New York City with the province of Quebec, along the Highlands of the Hudson and over the mountainous ridges of western New England.

Already that route is open, save for a break of about 20 miles near Mt. Mansfield, some 30 miles south of the Canadian border, and extends southerly along the Green Mountains over Camel's Hump and Killington Peak to Mt. Greylock, in the Massachusetts Berkshires, a distance of approximately 150 miles. Thus four of Vermont's largest State forests, not to mention the Middlebury College forest of 25,000 acres, that extends along the main range for a dozen miles, are connected, and the fact that the State Forester is giving material assistance to the undertaking is significant of its importance from his professional point of view. If that route should be eventually carried south, through co-operation with organizations in other States, across the Taconic range of Massachusetts

into northwestern Connecticut, as planned, and thence to West Point and down the Hudson Highlands, yet other public forests and reservations will be tied together. This would include the Mt. Greylock and Mt. Everett reservations in Massachusetts; it would run within striking distance of a 1,000-acre State forest in Connecticut, and end in the great interstate Palisades Park of New York and New Jersey. Should its eastern extension from Mt. Mansfield be carried over to New Hampshire, there to connect with the projected route north from the White Mountains, as more than likely it one day will be, the wildest and most picturesque sections of western and central New England will be included.

No one who is at all familiar with the famous walking routes of the highlands of the Old World, through the hill country around the English lakes, over the Black Forest ridges, across Switzerland from Lucerne to Chamonix via the mountain passes, or the somewhat less-known routes in Tyrol, will doubt the popularity that these New England path systems are destined to enjoy. It is along these mountain ranges, too, that new State forests are most likely to be established in the years to come, so that it is more than ever important that the forest authorities should begin to consider what their attitude will be toward the holiday throngs that will drift in upon their domain over these subaerial lanes.

Moreover, inasmuch as every forest that hopes to become important economically must have its road connection with the highway, if it does not actually abut upon a public road, such properties, when not too remote, will become important adjuncts in the stimulation of automobile camping tours. As this form of vacationing becomes more popular, camping sites on private land along the roads will doubtless command a rental value for the purpose. Every conveniently located public forest will then afford an appreciated haven, and if suitable provision is made by the administration in such places, tourists will plan their trips with reference to the public camp grounds indicated on their maps. Thus will be formed another system of reservations, not improbably including some of the units embraced within those of the footways.

All forest authorities agree that it is desirable to make public forests useful to the utmost extent. If such places in New England are not made available to the public for recreation in every reasonable way, one phase of their usefulness will be wasted. This does not need to be argued, however. It is admitted by every forester with whom I have discussed it. Such use will, of course, put new responsibilities upon the administrative officers of the forest. The presence of large numbers of campers and trampers in the woods unquestionably increases the fire menace. An official statement lays 18 per cent of the fires on National

Forests last year to campers, which was 2½ per cent above the average from this cause. The remedy for this is not prohibition, it seems to me, but more rangers, a stricter enforcement of the fire regulations, and, what is quite as important, the designation of camping places, especially in the most frequented sections, and along the most popular trails, where provision has been made for the building of safe fires. The furnishing of open log camps at such points, with fire trenches and suitable rock-work ready prepared, would be in the nature of preventive medicine. Such accommodations would be appreciated and used, and the danger from fires built in unsuitable places reduced. Instead of blaming the tenderfoot camper for setting the woods afire, he might be helped in this way to do the thing right.

Where mountain clubs and other outside agencies are willing to co-operate in the building of tourist trails, it is assumed that they would be encouraged (though not without suitable restraint). The administration can make many friends, however, by locating its own ranger trails and service roads, so far as may be possible, with an eye to developing and exhibiting the scenery. Probably nothing will contribute more completely toward the public enjoyment of the forests than the establishment of simple hostels at reasonable intervals along the main trails. Those out for a camping hike will be happy with the open-log shelters already alluded to; but there are those who prefer to travel with less in their tote-bag and more in their purse, to whom a simple, cleanly cabin lodging at a reasonable charge would appeal.

This has been amply proved by the experience of the Appalachian Mountain Club at its three "huts" in the White Mountains, where bunks and meals are supplied at moderate cost to an increasing number of enthusiastic campers every summer. The Dartmouth Club may yet decide to open its three camps located along the trail from Hanover to the mountains in a similar manner. More will be needed at several points in the White Mountains before the National Forest there can be made to thoroughly serve its purpose as a recreation field. Along the Green Mountain trail, also, these public hostels must sooner or later be introduced, and what more suitable locations could be found for them than on the State forests, wherever such exist? It is understood that one has already been opened on the Camel's Hump Forest.

It is not improbable that in the near future the demand for this form of public hospitality will so increase as to afford moderately profitable business possibilities. To encourage enterprise in this line, the Forest administration might well afford to supply building timber under free-use permit, and to grant ground leases upon very liberal terms—free

use, if need be, but always with service and prices to be subject to official control, as in the National Parks.

The idea here is to make these forests serve the purposes of parks without subjecting them to the restrictions upon the utilization of resources which apply to the purely recreational form of reservations. To satisfy the public in this respect, it will be necessary to afford them substantially the same advantages that are found in the parks. For example, if private enterprise does not supply authentic maps suitable for trampers' use, or guide books suggesting what to see and how to see it, and at reasonable cost, there would be every reason why the administration of any large forest that was much resorted to should provide these items at practically cost. In such a forest as that in the White Mountains, which is already resorted to by many thousands of people, such monographs as the National Park administration now sells to visitors, dealing with the geologic history of the region, telling the story of the trees and the animal denizens, or even a brief human history of the section, would be appreciated if intelligently written.

All these things will call for money outlays, but as they are not properly chargeable to the commercial aspects of the forest business, they should not be expected to come out of its revenues or regular appropriations. In the case of the White Mountain Forest, it is not improbable that in time the revenue from leases will be amply sufficient to cover all these items. A request for a special appropriation, however, might well be supported by the claim that it was for the promotion of the public morals and health. At all events, these are public properties, and as their recreational advantages come to be better appreciated the owners will insist upon their more complete development, which in the last analysis will be at their own cost.

This recreational use of any of the larger and most accessible public forest units will unquestionably present a problem of much difficulty for its administrators. It involves so many features that are quite outside the realm of forestry that the average man trained in that profession can not be expected to handle its details unaided to the best advantage.

It is understood that in the National Parks, when a problem in forestry arises, such as the removal of a stand of insect-infested or diseased trees as a protective measure, it is the custom to call upon the Forest Service for the loan of a forester to handle the situation. If the National Forests are to be treated in any part as parks; if the charm of certain notably fine sections of the forests is to be preserved for the benefit of pleasure-seekers; if trails and roads are to be located for the purpose of exhibiting scenery as well as for patrol and for getting out logs; if hotel and camp

sites are to be leased and the design and location of the structures regulated, then the Forest Service needs a trained landscape man upon its staff just as certainly as I believe that the National Parks require the services of a permanent forester.

In the White Mountain Forest, where camp, cottage, and hotel sites are certain to be in demand, such an officer would be particularly useful. Under his direction suitable sites for these utilities could be selected and appropriately subdivided in anticipation of an active demand. A well-considered working plan would seem to be as essential for this development as for any other branch of the service.

The average forester undoubtedly has as great a love and appreciation of the beauties of nature as any one—is above the average in this it may be conceded—but when he puts on his professional thinking cap in connection with a forest, he sees visions of thousands of board feet and not landscape. He may admire a "wolf" tree, but he does not love it. Such is his training. Why need he be jealous of the assistance of a man trained in landscape work, especially if a successful handling of the scenic incidents of his forests will tend to produce a more enthusiastic public state of mind toward Government forests in general?

THE USE OF THE NEW YORK STATE FORESTS FOR PUBLIC RECREATION

By George D. Pratt,

Commissioner of the New York State Conservation Commission, Albany, N. Y.

When within the borders of a single State there are found 1,814,550 acres of wild forest land and water, all under the ownership of the State, it can readily be understood that the question of the uses of this land for purposes of public recreation assumes important proportions. New York's forest preserve is twice the size of Rhode Island and larger than the State of Delaware. It embraces nearly 7,000 parcels of land, and is bounded by more than 9,000 miles of property lines. It includes the great Adirondack and Catskill parks, more than 170 islands in Lake George, and the St. Lawrence Reservation, all of which are ideally suited for camping and recreational purposes. There are also other reservations that do not come within the scope of this paper.

More and more in the last 20 years the public has turned to such wild forest land, and to the lakes and streams of the forests, for health and relaxation. This is particularly true in New York State, where the Adirondack Mountains, in which the State's largest holdings are located, are so easily reached from the country's largest centers of population. The Adirondacks are one of the oldest vacation resorts. Nevertheless, when the fundamental law was adopted, under which the State's forest preserve is administered, this question was not given the consideration that it certainly now merits. The constitution of the State provides that the lands of the forest preserve shall not be leased, sold, or exchanged, or taken by any person or corporation, and that the timber thereon shall not be cut, removed, or destroyed. This provision prevents the leasing of camp sites or any permanent occupancy. Several attempts have been made, the last during the session of the constitutional convention in the summer of 1915, to have this section amended to permit leasing for camping purposes, but without success. The entire administrative policy for the forest preserve must accordingly be worked out in harmony with the definite limitations imposed by the constitution.

The policy of the present Conservation Commission is two-fold. The Commission, upon assuming office, found about 800 cases of unconstitu-

tional occupancy, ranging from hotels to small parcels of land used for camp or agricultural purposes. These occupancies had multiplied through many years of lax enforcement of the constitution, and the fact that they existed, and had gone on practically unchecked, was undoubtedly the cause, in large measure, of the refusal of the constitutional convention to permit the leasing of camp sites. Following the adjournment of the convention, the Commission undertook at once the task of clearing the State land of every occupancy in violation of the constitution. In every way possible it has endeavored to clear up the situation by friendly methods. The occupants themselves have been appealed to, the requirements of the constitution have been presented to them, and they have been asked to co-operate with the Commission, and to sign a stipulation for their removal within a specified time. They have been allowed to remove their buildings where they wished to, and every other possible consideration has been shown them. It is a matter of extreme gratification to the Commission that by far the larger proportion of them are leaving in this way. Others will go through the courts. Only by such a cleansing of the atmosphere, and by making it understood that whatever regulations exist will be administered vigorously and impartially, can the highest development of the forest preserve as a recreation resort be brought about. To enforce the law as it exists, and thus to remove a long-standing barrier to further forward action, is one part of the Commission's two-fold aim.

The other side of the policy is to permit and facilitate the very widest possible use of the forest preserve for recreational purposes, while still keeping within the constitution. It must not be forgotten that this property is owned collectively by approximately ten million people, and that increasing thousands of them are actually making annual use of it for vacation purposes. It is estimated that fully 50,000 persons climbed the mountains of the Adirondacks last summer for the views from the tops. Over 1,300 climbed one mountain alone, and that not one of the most popular ones. Tramping has become a favorite recreation in all parts of the country, and the annual number of trail-hitters is increasing by leaps and bounds. In fact, the number of people who go into the open today for other than hunting and fishing purposes is now far in excess of those who rank as sportsmen. Since their stay upon the forest preserve hinges almost entirely upon shelter, the problem of the Conservation Commission is largely one of determining to what extent they may be allowed to put up shelters, and how they may use them. The regulations adopted have reference to the length of the occupancy and the

character of the shelter to be erected. The only shelters allowed are tents, with or without platforms, and open camps or lean-tos. Four classifications are recognized, as follows:

1. Tents without platforms, temporarily used. No permit for the erection of these is required.

2. Tents used for camping which is not of a temporary or transient nature. There may or may not be a platform. If a platform is used, it must be placed and removed at the same time as the tent. A permit is necessary for the erection of these camps.

3. Tents with permanently placed platforms. A permanent tent platform is a board platform upon which is erected a framework over which a tent may be stretched. There may be board sides to a height not exceeding three feet. These platforms remain from season to season, but become the property of the State. They are not to be occupied except under a permit, and the person who erects them has the preference in their allotment the following year. When not occupied, permits for their use may be given to any applicant. Portable canvas houses, which are essentially no more permanent structures than the tents with platforms and frames, are allowed under this classification, but they must be removed or become the property of the State. No locks are allowed on their doors.

4. Open camps, or lean-tos, are divided into two groups, the first for the transient traveler; the second for hunters, campers, and fishermen. Camps in the first group are limited to occupancy by the same party for not to exceed three nights in succession, or for not to exceed ten days in any one year. They are designed for the use of parties who climb the mountain trails or travel through the woods. It is intended that they shall be built on the main trails, and that they will make possible a much fuller enjoyment of the forest preserve than is now practicable, when the only shelter must be carried on the back.

The camps of the second group, for hunters, campers, and fishermen, will be built on other than the main trails, and their use by the same party will be allowed for reasonable periods. The idea underlying the word "reasonable" is that no one shall have the continuous use of the camps, but that every one shall be given a fair share in the facilities that they afford. The very plan of their construction makes even an attempt at permanent occupancy unlikely, though they furnish admirable shelter for reasonable camping periods.

No open camps are to be erected or maintained except under a permit, and the structures permitted are to be of a standard type. It is stipu-

lated by the applicant and in the permit that they become the property of the State when completed, and that they shall be open to the public.

An open camp, the form of structure so well known under the name of the "Adirondack lean-to," is open in front to the fire. The ends are enclosed, and the rear wall is much lower than the front opening. The roof slopes back to the rear wall. Its shape is much like that of a reflecting camp baker and its heating qualities are similar. Each camp must be equipped with a fireplace, built of stone and located about eight feet in front of the camp.

It is expected that under these new regulations many tent platforms will be erected in all parts of the preserve. Permits for a number have already been issued. The open camps of the first group, for the convenience of travelers, will doubtless be built almost exclusively by camp and trail associations and other organizations of similar character. Under rules less liberal several of these were erected years ago, and the Commission understands that applications for others are to be filed this season. The open camps of the second group will, as a rule, be erected by individuals. The provision for these camps is entirely new and will almost surely lead to a much wider and fuller enjoyment of the forest preserve.

Other advantages than those of making the woods more accessible to the public are to be claimed for these regulations. More people will use the fireplaces provided at the camps, instead of building open fires in the woods, and thus an appreciable amount of fire menace should be avoided. The people who use the woods will also come more under the instruction and regulation of the Commission, and this will mean a further decrease in fire hazard. Other regulations than those regarding the use of the shelters and the building of fires, such as those for sanitary precautions, against the felling of trees, etc., are the usual administrative rules for the policing of such a preserve.

One of these rules is that the use of the forest preserve or the improvements thereon for private revenue or commercial purposes is prohibited. This is not intended as a prohibition against the receiving of wages for personal services. The Commission desires to have guides continue to take parties into the woods and earn their living thereby, as they have always done. If the guide is paid the regular guide's wages and is reimbursed for any expenditures that he makes, these payments are not considered as profit from the use of the State land or the shelters that may be occupied. Thus a guide may secure a permit and erect an open camp, or several of them, and take his parties to them for temporary and reason-

able periods. So long as he does not receive additional payment because of the occupancy of the camp, there can be no complaint on the score of commercial profit.

It is believed that this is the most liberal plan for the use of the forest preserve which can be formulated under the present constitution. It should make possible far wider temporary use than heretofore, and at the same time cut down fire hazard and make more friends for the woods and for conservation. It certainly is a step in the direction of greater enjoyment by the public as a whole, rather than by a few favored individuals.

USE OF THE SOUTHERN APPALACHIAN FORESTS FOR RECREATION

By J. S. Holmes,

State Forester of North Carolina

AREA

The lands approved for purchase by the National Forest Reservation Commission up to March 31, 1916, comprise a total of 1,077,323 acres, in 6 States, as follows:

Virginia, 302,168 acres.	West Virginia, 109,101 acres.
Tennessee, 272,292 acres.	Georgia, 98,354 acres.
North Carolina, 271,943 acres.	South Carolina, 23,465 acres.

This is less than one-sixth of the total acreage included in the purchase areas already laid off, and hardly a tenth of what should eventually be acquired by the Government.

PROTECTION

The importance of these Forests for protection can not be overestimated. Practically all the larger rivers of the Atlantic, Gulf, and southeast Central States, from the Potomac round to the Ohio, have their sources in these mountains. The lower waters of these streams are navigable; the middle and upper reaches form abundant water power, while the headwaters furnish numberless towns and villages with permanent supplies of pure water, and form an ideal home for some of our best food fishes. Unless these streams are protected by an undisturbed forest cover, floods will result. Already floods have annually done inestimable damage because frequent burning and unrestrained clearing have greatly injured the watersheds.

TIMBER PRODUCTION

While the production of timber by these Forests is of less economic importance than their value for stream protection as well as for public recreation, the actual value of timber now being cut, as well as the possible production under management, makes this feature of very great importance. The Southern Appalachian region is the center of the

hardwood-lumber industry, which is now gradually retreating from the more level piedmont and central plateaus. The absolute forest land of the mountains will have to produce an increasing proportion of the country's supply of hardwoods as the agricultural lands surrounding them become cleared up.

The difficulty and expense of logging in such broken country suggests the advisability of practicing a *long* rotation. Most uses to which hardwoods are now put, such as the manufacture of furniture, interior finish, etc., demand aged timber, and the problem of the future will be to secure a reliable supply of this. Private landowners, with taxes to pay and interest on the investment to realize, will be obliged to cut on as short a rotation as is possible. The Government, on the other hand, having no taxes to pay or interest to meet, but simply paying out a proportion of the gross receipts, can afford to grow and hold the more valuable hardwoods for this special demand.

Such a practice will harmonize admirably with the two other more important uses of these forests, for protection demands that the soil cover be broken as rarely as possible with logging operations, and the beauty of the mature stands will add greatly to the attractiveness of the forests as recreation grounds.

RECREATION

The present and future value of these Forests for recreation far exceeds their value for timber, and the latter use should be subordinated to the former. It is said that over 30,000,000 people live within a day's ride of these Forests. Within 24 hours the city workers of New York, Chicago, St. Louis, or New Orleans can get into these mountain Forests—which are nearly always free from snow in winter and are always cool and bracing in summer—and there breathe in new life and health to enable them to take up again their daily routine. There is no wonder that visitors come both in summer and winter in ever-increasing numbers. Last summer 150,000 people visited the Asheville district of North Carolina alone. Already probably a million visitors annually come within walking or driving distance of the Southern Appalachian National Forests, and rapidly increasing numbers use them. We are now at the beginning of a recreational era; we are learning the value of relaxation and change of scene. Automobiles lead thousands from the heated plain to the cool mountains, from the bleak and snowbound North to the sunny South, from the dirty, noisy city to the fragrant wild. It is only necessary to make them accessible and to develop their attractiveness to have in these Southern Appalachian Forests the greatest natural resource

and the one most largely used and most highly appreciated of any National property in the United States.

Not only is their recreational value of importance to the *visitor*, but it creates a livelihood for the residents of the region; several million dollars must be spent in western North Carolina alone each summer by visitors. and almost an equal amount each winter, and the extent of the development of this industry it is impossible to limit.

ADMINISTRATION

It has been urged that the Appalachian National Forests should be made national parks and put under the National Park Bureau of the Interior Department. It has also been suggested that certain areas within the Forests be set apart as national parks, to be administered presumably, in the same way. These and similar ideas only show that the intelligent public, who know, love, and use these mountain Forests, are anxious to see the general devastation wrought by lumbering followed by fire brought to an end. While contending that recreation should be emphasized, I see no reason for taking their management from the Forest Service—which is thoroughly familiar with all conditions and the questions connected with their administration, and which is universally respected for its fair, efficient, and honest administration—and turning them over to another department, which has had no experience in handling eastern Forests or dealing with eastern problems. The traditional policy of the Forest Service is to handle the National Forests for the greatest good of all the people, giving the local population the preference where that does not interfere with their proper use. In many of the western Forests timber production is of first importance, grazing second, protection third, and recreation fourth. In others potection is most important, timber production second, and recreation third. The necessary modification in policy and management to meet the needs of the different Forests has not made it necessary to change the control; neither will it be necessary when it is realized that the recreational value of these Forests is of more importance than their value as a source of timber supply. The management will be modified to meet every legitimate requirement as it is recognized.

PURCHASE OF LANDS

Owing probably to the attitude of Congress, the present policy of the National Forest Reservation Commission is to purchase only low-priced lands. This results in the acquisition of cheap cut-over lands and the practical elimination of any extended areas of virgin forest. In my

opinion this is a very serious mistake, which is in large part responsible for the growing demand for the creation of national parks. There is no comparison between cut-over and virgin forest for recreation purposes. A cut-over spruce forest is a barren waste, destitute alike of life and beauty; it is equally valueless as a protection. With the vegetable soil all destroyed by fire, the heavy mountain rains soon wash away the remaining mineral soil, leaving little but rocks and stumps to retard the rapid surface flow to the larger streams. Certainly in North Carolina all areas of the spruce type, which altogether have not amounted to more than 300,000 acres, and which are now reduced to nearly half of that, should be purchased and held by the Federal, or, occasionally, by the State Government, for their value for protection and recreation.

Virgin forest, or that which has been lightly culled, as so many of the best timber tracts have, will of course cost more than cut-over land, so less of it can be purchased. Yet hardwood forests—such as those of western Graham and northern Swain counties, and spruce forests, like those surrounding Black Brothers and Celo, in Yancey county, North Carolina—can never be reproduced if once cut over without restriction. Such unequalled examples of the beauty and grandeur of our Appalachian Forests will be lost for all time unless specimen areas, at least, can be added to the National Forests.

FOREST MANAGEMENT

Forest management for these Forests must first of all recognize their primary value as cover for the protection of the headwaters of streams. Clear cutting, as at present practiced, could not be allowed, a modified form of the selection system taking its place in most cases. Logging would either be done to small portable mills, which will no doubt be improved into much more effective plants than most of them now are, or the more valuable species hauled on wagons over good roads to the railroad. For years walnut and cherry logs have been thus hauled long distances. The object of management would therefore be to produce a large proportion of aged trees of the valuable species, such as are not so likely to be grown on private forests.

Secondly, the Forests must be handled so as to be as attractive as possible to the recreation-seeking public. Large areas of virgin timber should remain uncut until past maturity, and, when cut, only the oldest trees, and those which are preventing reproduction or hindering the development of desirable standards, should be taken from such stands. There are in these mountains magnificent forests of hemlock on the high

"benches"; stands of white pine, almost or quite pure; wonderful spruce forests sheltering carpets of moss and twigs; coves full of the greatest variety of hardwoods, many attaining their highest development in these mountains. There is comparatively little of this virgin timber now held by the Government, because the value of such timber prevents its acquisition at prices which the Commission is willing to pay. Wherever such areas have been secured they should remain intact, at least until the purchases become consolidated and a general plan of development can be fixed.

DEVELOPMENT

The gradual development of these National Forests, which for the present must, to a certain extent at least, be subordinated to their more rapid acquisition, must aim to make easier and more effective their administration, and make them more accessible and more attractive to visitors, always remembering that the protection of the streams is the prime necessity.

A system of surfaced roads, equally good for hauling out timber and for automobile traffic, should penetrate and connect the various Forests with the near-by railroads and resorts. These roads should not only be connected with the main State and National highways, but should thread the more picturesque localities—valley, cove, waterfall, ridge, and peak being made accessible. Undoubtedly some co-operative plan for road construction could be developed, through which the Federal Government, the State, county, township, town, and individual could all take part in this work which would mean so much to each, somewhat as the city of Portland and private parties are assisting in building roads through the Mount Rainier National Forest.

In addition to these automobile highways, smaller wagon roads and trails should penetrate every part of the Forests. Some direct, through trails should be constructed for the benefit of pedestrians and campers; others into the more remote regions, for the benefit of fishermen and hunters as well as timber users, all contributing to the more thorough and economical administration of the Forests.

At suitable points along the main trails permanent indestructible camps should be constructed for shelter from the cold mountain rains, where users of the forests could spend the night. Imagine the joy of a walking or pack-horse trip from the Little Tennessee River along the crest of the Smoky Mountains, the Balsam Mountains, and the Pisgah range to Asheville—a stretch of some 200 miles almost without a house—camping at night in shacks owned by the Government, drinking the cold

spring water along the way, filling one's lungs with pure mountain air, one's eyes with the unexcelled scenery, and one's soul with the peace and rest of these forest-clothed heights.

GAME

The use of these Forests could be greatly increased by thoroughly stocking the woods with game and the streams with fish. Certain areas should be permanent sanctuaries, where breeding could go on undisturbed and where nature-lovers could hunt with field glass and camera without taking the lives of the beautiful creatures of the forest.

But through the larger part game and fish should be raised for a food supply and to increase the attractions for visitors. Under proper management the streams and woods are capable of yielding an abundant supply of deer, bear, coons, turkeys, grouse, and other game. Elk were formerly abundant, as indicated by many local names, and they can be repatriated. The grazing of cattle, sheep, and hogs, which is now a recognized and advocated use of the Southern Appalachian Forests, is of necessity only a temporary one. The State laws in force in North Carolina and other Southern States require owners to fence their stock, and not let it roam at large on their neighbors' property. This should even now greatly restrict the grazing use. But, in addition, there are very few areas which are absolute grazing lands. The "old fields" will gradually grow up or be planted to trees, and the open ridges, which now furnish forage of rough grasses, will, with protection from fire, rapidly restock with timber trees and shade out the grass. Only the "balds" on the summits of the high mountains will be left as profitable grazing grounds. The future forests will therefore be much more suitable for grazing deer and elk than sheep and cattle, and the former can be made to yield a much greater revenue to the Government and more valued returns to the people of the country. Permit fees of $5 or $10 for killing a buck, and $20 to $25 for an elk, will bring in more revenue than pasturing cattle at 40 cents per head.

The numberless mountain streams should be restocked with fish, and protected until they yield an abundant supply of game fish as well as good food. There is already a Federal fish hatchery in northeast Tennessee; and, with a second in southwest North Carolina, not only could the Government streams be stocked, but adjacent waters in private ownership, under co-operative agreements and protected by the State laws, could be utilized to increase the local food supply and assist in making this the sportsman's paradise of the Southeast.

PERMIT SYSTEM

In order to bring about the greatest possible recreational use of these Forests it will probably be advisable to control the users through a liberal free and pay permit system. Permits for some uses might be issued by the rangers, while for others they would have to be signed by the supervisor. They should specify name of holder, nature and duration of use, and should be subject to inspection on demand of any forest officer. A book of rules governing the use of the Forests should be handed to each permittee. There should be included in this rules concerning the use of fire, the cutting of firewood, the number and size of fish to be taken in the day or period, the kind and amount of game to be taken, the use of trails and cabins, the protection of springs and private and municipal watersheds, the location of camps, and such like.

At first such a permit system might appear to be irksome, but the public would gradually find that by it they were protected from the results of the acts of unscrupulous and irresponsible parties, and it would soon work out to the benefit and convenience of all concerned.

The Government has already inaugurated a policy of encouraging the use of certain forest areas for summer camp sites, and such privileges have been taken advantage of by the public to a surprising extent. This policy, broadened out to include many other recreational features and to cover all the Southern Appalachian Forests, will bring in a body of careful, responsible seekers after health and recreation, which will make these Forests the best known and the most truly useful to all the people of any in the United States.

USE OF THE NATIONAL FORESTS OF THE WEST FOR PUBLIC RECREATION

By E. A. Sherman,

Assistant Forester in Charge of Lands, Forest Service

With three able men, each handling this subject from his own viewpoint, in advance of my position on the program, I have entertained the feeling that the recreational field of the public Forests would be very completely covered without my contribution. I have therefore hesitated to prepare a formal paper upon this subject, and in lieu thereof will merely submit a brief memorandum covering a few of the aspects of this topic, which at the present time stand out as being of sufficient importance to warrant mention.

The rallying cry of "use," as later modified by the slogan that each tract of land within the National Forests should be put to its highest use, is being further modified, until we are beginning to realize that in some instances the highest use may include what many practical men would consider non-use. As Rock Creek Park is being put to its highest use at the present time, while maintained as a place for the benefit and enjoyment of all the people of Washington, as it stands a perpetual invitation to enjoy God's sunlight and fresh air and nature's abundant beauties, so for a number of years it has been dawning upon us that many areas within the National Forests will similarly, in the fullness of time, be put to their "highest use."

When the public-spirited citizens of Multnomah county, Oregon, expended approximately a million dollars in the construction of a scenic highway through the gorge of the Columbia River, they found that at a number of points their road crossed Government-owned lands in the Oregon National Forest. At the same time the forest officers in that district found that the greatest value of these areas consisted in the benefit which might be derived from them by the people of the city of Portland and other residents of Oregon, and, in fact, people from every State in the Union, in connection with the enjoyment of the public highway. This self-evident truth, which before the construction of the road would have been scouted as a visionary dream, was immediately recognized by every one. It resulted in the Secretary of Agriculture formally pro-

claiming 13,873 acres as the Columbia Gorge Park Division of the Oregon National Forest, classifying it as chiefly valuable for public recreation and use in connection with the use of the scenic highway, and solemnly dedicating it to that purpose.

Two years ago Supervisor Charlton, of the Angeles National Forest, decided that $2,000 of the fund of $10,000 contributed by the county for road construction within that Forest should be expended in constructing a public road up a certain canyon. At that time a small summer resort, operating under permit and paying an annual rental of $25, was established at the head of the canyon, and was accessible only by trail. After the road was constructed, Mr. Charlton told some of the newspaper men of Los Angeles that in this canyon, along the road, were a few places suitable for summer homes. Immediately he was flooded with applications. He thereupon decided upon a systematic survey of the canyon in order to determine its actual possibilities in the way of summer home sites. As a result, 250 suitable sites were surveyed and platted, and at the time I visited his office, less than six months later, 226 of them were already under special use permit.

The construction of a reservoir in the high Sierras has put a new lake on the map. Huntington Lake, in the Sierra National Forest, is an artificial lake resulting from a dam constructed by a hydro-electric power company, and is only one of many such monuments which give the lie to the charge that you can not secure development of water power under Government regulation. Supervisor Redington had sufficient imagination to see the beauty of the lake even before the dam was finally completed and the body of water actually in existence.

District Forester Du Bois reports that already there is a keen demand among the residents of San Joaquin Valley for summer homes on the shores of Huntington Lake, and the Forest Service has authorized the expenditure of approximately $1,500 in order to furnish an adequate supply of domestic water to the area. It is believed that within five years there will be a permanent summer colony of two or three thousand people enjoying the healthful outdoor advantages of this public property, and bringing back to their homes in the San Joaquin Valley the strength, courage, and vigor of the mountains.

On the shores of Lake Tahoe the Federal Government owns only two fractional lots of land, amounting to about 26 acres. Last summer a careful survey and examination was made of this area and an 80-foot strip along the lake front was reserved for common property, a bathing beach established, and a public camp ground provided for. One street of the most desirable lots was laid out along the lake front. Forty-six

lots were surveyed, each lot measuring 75 by 150 feet. These are retained for summer homes to be established under Government regulation. At the present time there is a halt in the development of the recreation plan, for the reason that a bill has been introduced in Congress directing the Secretary of the Interior to issue a patent to this tract of land to a Nevada corporation. It appears that 16 or 17 years ago the State of California attempted to select the lands in question. Later on the State sold them. Some time after the sale was made the attempted selection was canceled by the General Land Office. However, the State continued to accept the money from the former purchaser, and finally deeded the land to him, regardless of the fact that its attempted selection had been canceled. Now comes the Overland Trust and Realty Company of Reno, Nevada, stating that it holds title as assignee of the equities of the previous purchasers, and requests that the land be deeded to it without further consideration. It is difficult to see where this corporation has any claim upon the land, either in law or equity. They say that the Woolworth building is sold over a hundred times every year to men with long whiskers, but such sales are not taken seriously by the owners of the building. It is not believed that Congress will give serious consideration to the claim of the Nevada corporation, but that, on the contrary, in the future we will find a little strip of Government land on Lake Tahoe serving a high and worthy public purpose. At the present time a portion of the site is under consideration as a location for a summer home for girls, under the direction of a benevolent organization of the State of California.

These are only a few examples of what is being done along special use and recreational lines in the National Forests. You all know about the recreational folders that are being issued from time to time for different Forests as rapidly as the data can be compiled and as funds are available for publication. This summer for the first time, and as a direct result of the stimulus received from the act of March 4, 1915, which authorizes term leases for a period of thirty years, each National Forest district is undertaking a few recreational reconnaissance projects. A definite procedure has been tentatively established and the form of report determined upon, together with a method of survey, and even the details of monumentation have been definitely determined. The work is only in its infancy. So far as the Branch of Lands is concerned, I believe that in the future the recreational use and development will be our most important line of work. There was a time when precedence was given to boundaries. During that time the National Forests of the West assumed their present general form. This was followed by a period when precedence

was given to claims work. Thousands of fraudulent claims were defeated, until now the questions of land titles within the National Forests are comparatively few and simple. This was followed by a campaign of Forest homestead work, as a result of the passage of the act of June 11, 1906, and it in turn was succeeded by the broader phases of land classification. Now I believe that the big work of the future is the work of occupancy. What may be the limits of its ultimate possibilities only the future can tell.

HYLOBIUS PALES AS A FACTOR IN THE REPRODUCTION OF CONIFERS IN NEW ENGLAND

By E. E. Carter,

Assistant Professor of Forestry, Harvard University

It is generally known that there are few areas in New England where white-pine reproduction has been secured promptly after the removal of an old stand of the same species. The reason commonly assigned is that hardwoods, already present under the old stand, grow vigorously after their release and crowd out the pine. This explanation does not always satisfy, however. In one case, the writer advised the removal of a broken stand of limby, pasture-grown pine over a veritable carpet of pine reproduction two to six inches high, with very few hardwoods present. Three years after cutting there were alive not more than ten per acre of these thousands of young pines, and the area was grass-covered. The exposure of the ground is not a sufficient explanation of this almost complete loss. Similarly, plantations of coniferous stock established on recently cut-over pine lands have usually failed. Various theories, such as extreme soil acidity due to rapid decomposition of the leaf litter and humus, have been advanced to explain these failures, but there has been no definite information available on the point heretofore.

In an effort to ascertain the causes of these troubles, a plantation of fairly good 2-1 white-pine stock was established in May, 1914, on the Harvard Forest, Petersham, Mass., on an area from which a heavy stand of pine had been cut clean during the previous winter. The local topography makes the prevailing wind distinctly southwest, and the area planted was near the windward side of the open area. A total of 561 pines were set out carefully, covering about half an acre, with about another 100 Norway spruces set in the partial shade of the adjoining stand. This plantation was inspected about once in two months during the growing seasons of 1914 and 1915, and a record kept of the condition of each tree.

Considering only the white pines at present, the first inspection, on June 26, 1914, showed that there had been a very small planting loss, and that 88 per cent could be classed as thrifty. The second inspection, on August 3, 1914, showed a loss of 11 per cent of the trees, with another 6 per cent weak, thus leaving 83 per cent thrifty. This was somewhat disap-

pointing, but not unsatisfactory. A third inspection was made on September 3, 1914, and it was at once apparent that there had been a heavy loss, and also that many more trees were dying. An examination of a tree then dead, but recorded as thrifty a month before, showed that the bark on the stem had been almost completely removed, leaving the wood bare. On the stems of a number of thrifty living trees snout beetles were found busily devouring the bark, usually on the part of the stem from which the needles had fallen, but sometimes even on the growth of the current year. The loss from this girdling alone had been 16 per cent, disregarding trees reported as dead in August. Another 12 per cent were so badly damaged that death was almost certain, and another 3 per cent had been attacked, but were not yet injured too severely to recover if no more damage occurred. A very careful inspection of the trees recorded as dead in August showed that over a third of them, or 4 per cent of the total number planted, had unquestionably been killed by the same cause, and in this work, as during all subsequent inspections, the beetles were given the benefit of any reasonable doubt. In short, this inspection of September 3, 1914, showed that only 55 per cent of the total number planted were thrifty and uninjured, 3 per cent were weak or sickly as a result of poor planting, drought, or poor stock, 7 per cent had died, presumably without injury from insects, 3 per cent had been partly girdled, 12 per cent had been practically girdled, but still had green needles, and 20 per cent had been killed by these snout beetles.

Prof. C. T. Brues, of the Department of Entomology, Bussey Institution, very kindly consented to identify the specimens of these beetles collected on September 3, 1914, and at later dates. He states that they are *Hylobius pales* Herbst, a beetle known to breed in the bark of pine stumps or of recently killed trees. So far as can be determined, there is no record of the work of this species on the smooth bark of thrifty trees, although in the Year Book of the Department of Agriculture for 1905 there is a statement that "the large stems (of seedlings) are gnawed by wasps, sawfly larvæ, and adults of snout beetles." The wholesale killing of the trees in this plantation and of near-by natural reproduction has surprised the entomologists before whom the facts have been presented.

At each of the subsequent inspections of this plantation Hylobius beetles were collected in the act of feeding. The loss plainly attributable to them increased steadily until in September, 1915, it amounted to 61.7 per cent, with an additional 9.5 per cent so severely injured that death seemed certain. Over 70 per cent loss has occurred from this one cause, and only 10.6 per cent loss from all other causes. Less than 20

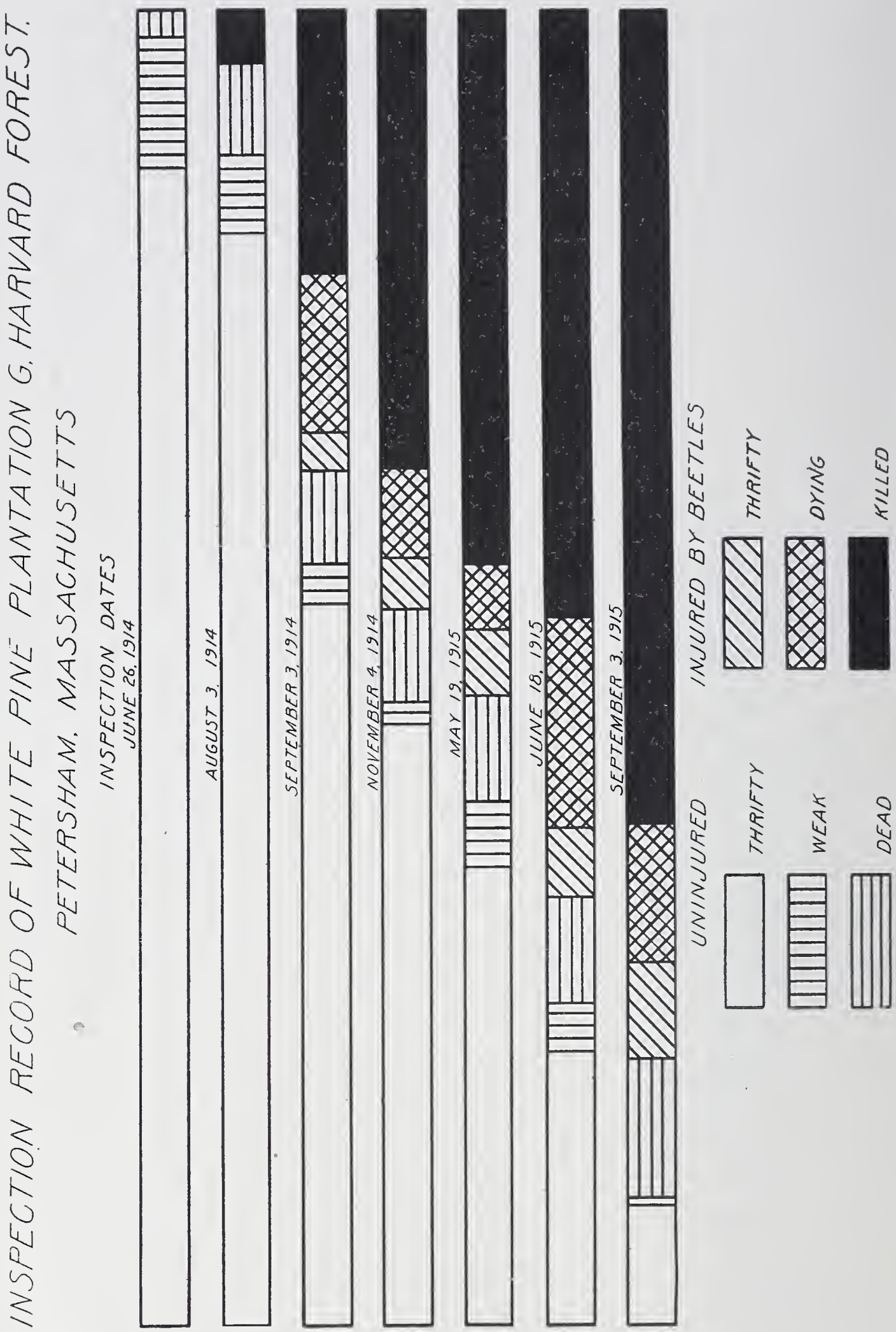
per cent of the pines planted were alive, and likely to grow if no further insect damage occurred after September 3, 1915, and nearly half of these had been attacked. At least 50 beetles were taken from the area as specimens at the time of the various inspections, and since it seems probable that each would have killed at least one more tree, the actual loss was probably less than if the plantation had not been under close observation. Some trees from which Hylobius beetles were taken were not attacked again, and were among the 17.5 per cent called thrifty on September 3, 1915. Observations on this plantation and elsewhere tend to show that the beetles move with the wind rather than against it, so it is unlikely that the loss in this case was increased by the presence of stump land to leeward, not planted until the spring of 1915. The record of the inspections is shown in the accompanying table and diagram. Needless to say, the plantation is considered a failure.

Work of Hylobius Pales in White Pine Plantation G. Harvard Forest. Petersham, Mass.

Condition of trees.	Dates of inspections.						
	6-26-14	8-3-14[1]	9-3-14	11-4-14	5-19-15	6-18-15	9-3-15[3]
Not injured:	*Per cent.*	*Per cent.*	*Per cent*	*Per cent*	*Per cent.*	*Per cent.*	*Per cent.*
Thrifty	88	83	55	45.9	35	21.0	9.1
Weak	10	6	3	1.6	5	3.6	.7
Dead	2	7	7	7.1	8	8.2	10.6
Injured:							
Thrifty	..	..	3	3.8	5	5.2	8.4
Dying	..	..	12	6.8	5	16.0	9.5
Killed	..	4	20	34.8	42	46.0[2]	61.7

[1] Inspection covered rows 5–13 only.
[2] Killed by beetles in rows 5–12, 36.1 per cent only.
[3] Inspection covered rows 5–12 only.

It required very little investigation to prove that the results in the test plantation were not due to a purely local epidemic. After what to look for was once known, it was easy to find beetles at work within or on the borders of any recently cut-over pine land in Petersham, Mass., or its vicinity. A plantation over 20 miles away, established in May. 1913, on land cut over in the winter of 1912-13 and burned over in April, 1913. showed very heavy loss, from 40 per cent to 80 per cent. and beetles still at work in September, 1914. Natural reproduction, within or on the edges of recently cut-over pine wood lots in Petersham and its vicinity, was seriously damaged both in 1914 and 1915. Repeated inspections of


INSPECTION RECORD OF WHITE PINE PLANTATION G. HARVARD FOREST.
PETERSHAM, MASSACHUSETTS
INSPECTION DATES
JUNE 26, 1914
AUGUST 3, 1914
SEPTEMBER 3, 1914
NOVEMBER 4, 1914
MAY 13, 1915
JUNE 18, 1915
SEPTEMBER 3, 1915
UNINJURED
INJURED BY BEETLES
THRIFTY
WEAK
DEAD
THRIFTY
DYING
KILLED

natural reproduction on wood lots in Sagadahoc county, Maine, showed heavy losses in the first and second summers following cutting, amounting to 20 per cent killed and an additional 25 per cent injured by October of the first year, and the finding of dead two-year-old natural seedlings is difficult, so these percentages are certainly conservative. Specimens of the beetles were taken in Maine, and identified by Professor Brues. It will take time to determine whether conditions in 1913, 1914, and 1915 in New England were unusually favorable for an epidemic of *Hylobius pales*, but in view of the many past failures to save pine reproduction, natural or artificial, on cut-over pine lands, it seems doubtful whether the conditions in those years were abnormal.

Of course, check tests were established on the Harvard Forest in 1915, partly for the purpose of determining at what season the damage began The planting of the remainder of the area partly covered in 1914 was completed. The deaths from beetle work amounted to 17 per cent by September, with another 18 per cent attacked, but not yet killed. This was the second year after cutting, and there were almost no coniferous trees on the planting area to serve as food during the first year. Another area cut over in the winter of 1914-15 was partly planted (363 trees). By June 25, 48 trees, or 13 per cent of the total number planted, had been attacked, and over half of those were almost certain to die. On still a third area, cut over partly in the winter of 1913-14 and partly in 1912-13, an inspection on June 25, one month after planting, showed 27 per cent attacked, with some already dead. I have been informed that this plantation lost about 30 per cent of its number during the year, although 1915 was a year when drought did no injury to plantations in Massachusetts.

Another phase of the problem presented by *Hylobius pales* is the presence of advance growth in fields or pastures which it is proposed to plant with coniferous stock, especially white pine. When these scrubby, potential "wolf trees" were cut out of such planting areas on the Harvard Forest in the spring or fall preceding planting, the pines planted within 10 to 15 feet of the leeward side of those stumps, and often some trees on the windward side, were almost sure to be attacked by the beetles. Around one stump, less than 5 inches in diameter and only 6 inches high, the beetles killed four planted Scotch pines. Larger stumps were not always proportionately dangerous; but the data shows that all freshly cut pine stumps are distinctly a menace to the forester's ideal of an evenly spaced stand. No damage around these sappy, quick-rotting stumps was noted in the second year after cutting, but the damage the first year was often enough to cause a noticeable blank in an otherwise excellent plantation.

White-pine seedling, in fifth growing season from seed, girdled by Hylobius pales

(About 3/5 natural size)

a. Hylobius pales. (1 1/3 natural size)
b. Hylobius pales feeding. (1 1/3 natural size)

From what has already been said, it may be judged that the damage caused by these beetles is confined to relatively small trees. The beetles apparently prefer bark covering wood grown during the previous summer or the second previous summer, which makes them especially dangerous to white-pine planting stock of the sizes and ages most commonly used. They do not, however, confine their attacks to trees of these sizes or to bark covering wood of these ages. A few natural seedlings germinating in the spring following cutting were attacked and killed by these beetles during the fall of the first year, although others were not attacked under similar conditions. Similarly, trees older than 3 years were frequently damaged, and sometimes killed. One white-pine tree nearly 3 feet high, showing 7 annual rings at the ground, was found girdled with beetles still at work on it. Natural seedlings up to 18 inches tall on the edges of cut-over pine stands were frequently found dying or to have been killed as the result of girdling by these beetles; but two or three-year-old seedlings of normal growth suffered more severely than larger trees, since the removal of a small volume of bark from their stems proves fatal.

Serious damage, likely to cause the death of the tree, appears to be confined to trees under 3 feet high, but twigs of larger trees, especially of white pine, pitch pine, and hemlock, were repeatedly found to have been attacked by these beetles, and in some cases to have been killed. In one case a dense group of white pines 30 to 40 feet tall, but of too small diameters to be merchantable, had been left in the middle of a pine wood lot which was otherwise cut clean. Many small twigs on these trees were killed by the beetles. It is easy to attribute the injury to these twigs to the sudden exposure of the ground and the crowns to light and wind, and some of the injury was probably caused by this exposure. Definite cases, however, where the two or three-year-old bark on the limbs of white pines up to 18 inches d. b. h. had been partially or wholly removed were found in the course of the investigation of the work of *Hylobius pales*, both in Massachusetts and in Maine. Similar injury has been observed elsewhere, although probably due to some other species of snout beetle than the one under discussion.

As has been stated, the injuries due to the work of *Hylobius pales* were first noted on white pine. The adult form of this beetle, however, is not fastidious in its choice of food. Apparently the bark on two or three-year-old stems or twigs of most conifers is relished. During the investigations of the extent of injury done by these pests, the beetles were collected in the act of feeding on three pines, *Pinus rigida* Mill., *Pinus sylvestris* L., and *Pinus ponderosa* Laws, in addition to *Pinus strobus* L.; on *Abies balsamea* Mill.; on *Picea abies* (L.) Karst. (*P. excelsa* Link.);

and on *Pseudotsuga taxifolia* (Lam.) Britton. Equally conclusive to those who were engaged on the study was the presence of characteristic injury on the stems or twigs of trees and the finding of Hylobius beetles resting on or in the ground at the bases of the trees. This occurred hundreds of times on trees of all sizes, from two-year-old seedlings up to open grown trees 18 inches d. b. h., and the beetles so secured were identified with those collected on the same areas in the act of feeding. This combination of characteristic injury and the finding of beetles at the bases of the injured trees was observed with all the species previously mentioned, and also with *Pinus resinosa* Ait., *Larix laricina* (Du Roi) Koch., *Tsuga canadensis* (L.) Carr., and *Juniperus communis* L. Characteristic injury was repeatedly observed on *Picea rubra* (Du Roi) Dietr., and in one case on *Larix europæa* De., but no beetles were collected either on the stems of the injured trees of these species or at their bases. There can be little doubt that these species are acceptable as food to the Hylobius beetles; but proof to the same extent as with other members of the same genera previously mentioned can not be presented at this time. No opportunity presented itself to determine whether the beetles would attack *Juniperus virginiana* L., the only other common conifer in central Massachusetts.

One conifer growing abundantly in southern Maine appeared to be rejected by these beetles, since it was found to be uninjured when growing in the vicinity of freshly cut pine stumps and in mixture with injured or killed balsam fir, white pine, red spruce, and eastern larch. This was eastern white cedar, *Thuya occidentalis* L. A further test of the immunity of this species was made on the Harvard Forest in 1915. In the spring of that year half a dozen scrubby white pines, 6 to 10 inches d. b. h., were cut in an old field. Around some of the stumps of these trees three-year-old Thuya seedlings were planted in a circle, with white pine, Norway pine, Douglas fir, or western yellow pine outside the circle of cedars. Around other stumps pines only were planted The beetles promptly attacked all species except the cedar, and usually took the nearest trees except where cedars were nearest. Here, again, beetles were collected in the act of feeding, and identified by Professor Brues. It would therefore appear that Thuya alone, of all the coniferous species observed growing in the vicinity of fresh-cut pine stumps in southern Maine and in central Massachusetts, is immune to the attacks of *Hylobius pales*.

The extent to which different species of young coniferous trees of the sizes used in planting suffer from the attacks of these beetles appears to depend chiefly upon the character of their bark. White pine and balsam

fir have tender, thin bark, and a single beetle can eat off enough bark to kill a two or three-year-old seedling in a few days. Pitch pine, Scotch pine, and western yellow pine have a relatively thick, heavy, rough bark, and possibly the greater amount of pitch produced by these species when wounded may retard the activities of the beetles somewhat. At all events, in the areas under observation these rough-barked species were killed more slowly under similar conditions of exposure to attack than white pine or balsam fir, and it is probable that under given conditions a smaller number would be killed than would be the case with white pine. Norway spruce appeared to be more resistant than white pine or balsam fir, but less so than the rough-barked pines. In one plantation of Norway spruce on stump land a loss, attributaable to these beetles, of about 25 per cent occurred in the first year, and many more trees were injured, but were able to recover later. If the record of the 109 spruces planted on the edge of the pine plantation first described is taken by itself, the conclusion might be drawn that the beetles do little damage to Norway spruce, and prefer pine bark for food, since only two of the 109 trees had been killed by the beetles at the end of the second growing season, and only 7 others had been seriously injured. This slight loss, compared with that in the adjoining white pine, may have been due in part to a preference for pine bark on the part of the beetles; but in view of the heavy loss in other spruce plantations in mixture with or adjoining white pine, it seems more likely that the location of these spruces in the partial shade of an adjoining stand, and on the windward side of the cut-over area, played a more important part in the lack of serious damage. It should also be noted that the spruce was very thrifty 2-2 stock when planted, and individual trees were able to recover after the removal of an amount of bark from their lower stems which would have killed a three-year-old white pine. Under more normal conditions the loss of Norway spruce was sufficient to make the planting of this species on freshly cut-over pine land of very doubtful advisability.

Unfortunately it is impossible to present at this time a complete series of observations to determine how long after the cutting of a pine stand damage to reproduction on the same area may be expected to continue. The data heretofore presented shows that heavy damage, sufficient in extreme cases to ruin a plantation, has occurred the second year after cutting, and there are some indications that, if planting is deferred until the third season after cutting, some damage may occur. On the other hand, a plantation established in the spring of 1914 on land stripped of a heavy pure stand of pine in the winter of 1910-1911 was unharmed, although all other conditions were favorable for the development of

beetle injury, and natural reproduction had been injured in 1914 on a more recent cutting area within a quarter mile of this plantation. The indications are, therefore, that it is safe to plant the fourth year after cutting, but very unsafe to plant the second year after cutting. No conclusive data is as yet available in regard to the safety of planting the third season after the removal of a pine stand.

The more important conclusions which may be drawn from the foregoing data are:

(1) It is a waste of money to plant cut-over pine lands during the first two seasons after cutting if the coniferous species most commonly planted in New England are used. It may be expected that such plantations will be subject to heavy loss, in some cases amounting to almost complete destruction, from the attacks of *Hylobius pales*. It is probably safe to plant in the fourth growing season after cutting, but in most cases where the establishment of coniferous reproduction is so long delayed hardwoods will have occupied the ground and will have made strong growth.

This conclusion is in accordance with the practice in many parts of Europe, although the species, and even the genera, of both trees and insects are different from those in New England.

(2) Planters should be cautious about cutting out advance growth of pine in pastures or fields in New England when planting coniferous stock. More or less loss around the stumps of the trees so cut is almost certain to occur. If the advance growth can not be removed two or more years in advance of planting, it would probably be better to leave the advance growth and make early thinnings to prevent the development of wolf trees.

(3) The injury done by *Hylobius pales* is an added argument against the use of the shelterwood method in attempting to secure pine, either in pure stands or in mixture with hardwoods, after the cutting of an old stand of pine. The final cutting after the pine reproduction has started merely invites the destruction of the small trees by the beetles. This is, of course, merely an additional difficulty in the use of the shelterwood method, and is, under the conditions cited, no more important than the difficulties found in practice due to the almost inevitable abundant reproduction of hardwoods.

(4) Injury to pine reproduction may be expected as a result of attempts to reproduce a pine stand by cutting in strips, especially if the strips progress from the leeward to windward. In the investigations here reported, damage to pine reproduction was almost invariably found on the leeward side of a freshly cut-over pine stand, sometimes extending

as far as 100 yards from the edge of the old stand, but usually confined to the first 50 yards if reproduction was abundant. If the strip method of reproduction is used, the intervals between the cutting of strips should be sufficiently long for the reproduction to have reached a height of 3 feet or more before the timber on the next strip is cut.

The writer wishes to express his deep appreciation of the assistance given by Professor Brues in identifying the beetles collected in the field work here reported and of the helpfulness of Prof. R. T. Fisher, of the Harvard Forest School, throughout the work.

THE GROWING STOCK AS A CRITERION OF NORMALITY

By A. B. Recknagel,

Professor of Forestry, Cornell University

Growing stock is a general term referring to the standing timber upon a unit of area. When used in relation to problems of management, it usually refers to the volume of standing timber; but it may also be used with reference to the density of stocking, age classes, etc.

The normal growing stock (NV) is theoretically attained from normal age classes and normal increment; practically it results from normal age classes and actual increment.

The actual growing stock (V) is that which is present on a given forest. This is obtained by timber estimating.

The normal growing stock (NV) is obtained (1) by formula, (2) from yield tables.

(1) The normal growing stock is expressed by the formula $NV = \frac{ri}{2}$, where NV = normal volume of growing stock, r = rotation, and i = the mean annual increment.

(2) NV can also be determined directly from yield tables constructed by measurements of fully stocked stands.

NV then equals $N\left(a + b + c \ldots + \frac{M}{2}\right)$, where N = number of years in each age class (step of the yield table) and $a, b, c, \ldots M$ = the volume per acre given in the table for each age class.

The method and correctness of finding NV (1) by formula, (2) by summation from yield table, is illustrated on the accompanying diagram. For the values as given in this diagram, which is based on a yield table for white pine constructed by W. J. McCarthy, M. F., in the vicinity of Ithaca, N. Y., the normal growing stock would be as follows, assuming a forest of 1,000 acres:

(1) $NV = \frac{ri}{2}$ r = rotation = 140 years.

i = mean annual increment per acre = 281.64 board feet.

$$NV = \frac{140 \times 281.64}{2} = 19{,}715.$$

$19{,}715 \times 1{,}000 = 19{,}715{,}000$ board feet.

(2) $NV = N\left(a + b + c \ldots + \frac{M}{2}\right)$

N = number of years in each step of yield table = 10.

$a, b, c, \ldots$ are volumes per acre in each step of yield table.

M is volume per acre at the rotation age (140 years).

$$NV = 10\left(3{,}580 + 8{,}600 + 12{,}580 \ldots + \frac{39{,}430}{2}\right)$$

$$= 2{,}996{,}950 \times \frac{1{,}000}{140 \text{ years}} = \frac{2{,}996{,}950{,}000}{140} = 21{,}407{,}000 \text{ board feet.}$$

A further comparison of the two methods of determining the normal growing stock is given in the following table. These calculations are based on Hanzlik's yield table for Douglas fir as given in Forestry Quarterly, Vol. XII, No. 3, pp. 442-445. The rotations used were those given in table 6, p. 447, of the article cited. Premise: 100,000 acres of Douglas fir in western Washington.

Comparison of Two Methods of Determining NV.

Basis F. Q., XII, 3, pp. 442-5.	Rotation age (years).	A.—By formula.		B.—By summation.		Per cent B is of A.
		Cubic feet, whole stand.	Board feet, merch. only.	Cubic feet, whole stand.	Board feet, merch. only.	
Table 1....	[1]52	470,600,000	.....	334,134,615	.....	77.8
Table 1....	110	.....	5,500,000 M	.....	4,161,400 M	75.6
Table 2....	55	404,250,000	.....	397,000,000	.....	98.2
Table 2....	110	.....	3,700,000 M	.....	2,890,900 M	78.1
Table 3....	50	282,500,000	.....	216,900,000	.....	76.8
Table 3....	115	.....	2,903,750 M	.....	1,979,451 M	68.1
					Average..	79.1

From this table one might conclude that the formula values should be reduced by 20 per cent—*i. e.*, multiplied by .8—since summation is undoubtedly the more accurate method of the two.

Many authors have busied themselves with the problem of how to determine the normal growing stock most accurately and have suggested certain departures. Thus Flury[2] claims that the formula $NV = \frac{ri}{2}$, to

[1] For B it is necessary to find even decade values and then take proportional part of the difference.

[2] Schweizerische Zeitschrift für Forstwesen. March. 1913. briefed Forestry Quarterly. Vol. XIII, No. 1, pp. 108–113.

be more generally correct, should read:

$$NV = c \times r \times i$$

in which c is a variable constant. To determine this constant, normal yield tables are necessary, which may be summed up by the formula

$$NV = N\left(a + b + c \ldots + \frac{M}{2}\right) = S$$

then, since $c \times r \times i = S$

$$c = \frac{S}{r \times i}$$

Flury has calculated "C" for the chief species of Europe and for various rotations, as shown in the following table. These values are for timber-wood only.

Average Value of Constant "C."

Species.		Rotation in years.			
		60	80	100	120
Spruce	Swiss foothills	.371	.463	....	....
	Swiss mountains	.316	.392	.453	.508
	Prussia	.268	.354	.434	.519
Fir	Württemberg	.205	.267	.308	.359
	Baden	.226	.317	.384	.437
Scotch pine	North German plains	.387	.454	.503	.536
	Prussia	.374	.456	.525	.596
Beech	Switzerland	.276	.341	.405	.467
	Prussia	.219	.316	.379	.428

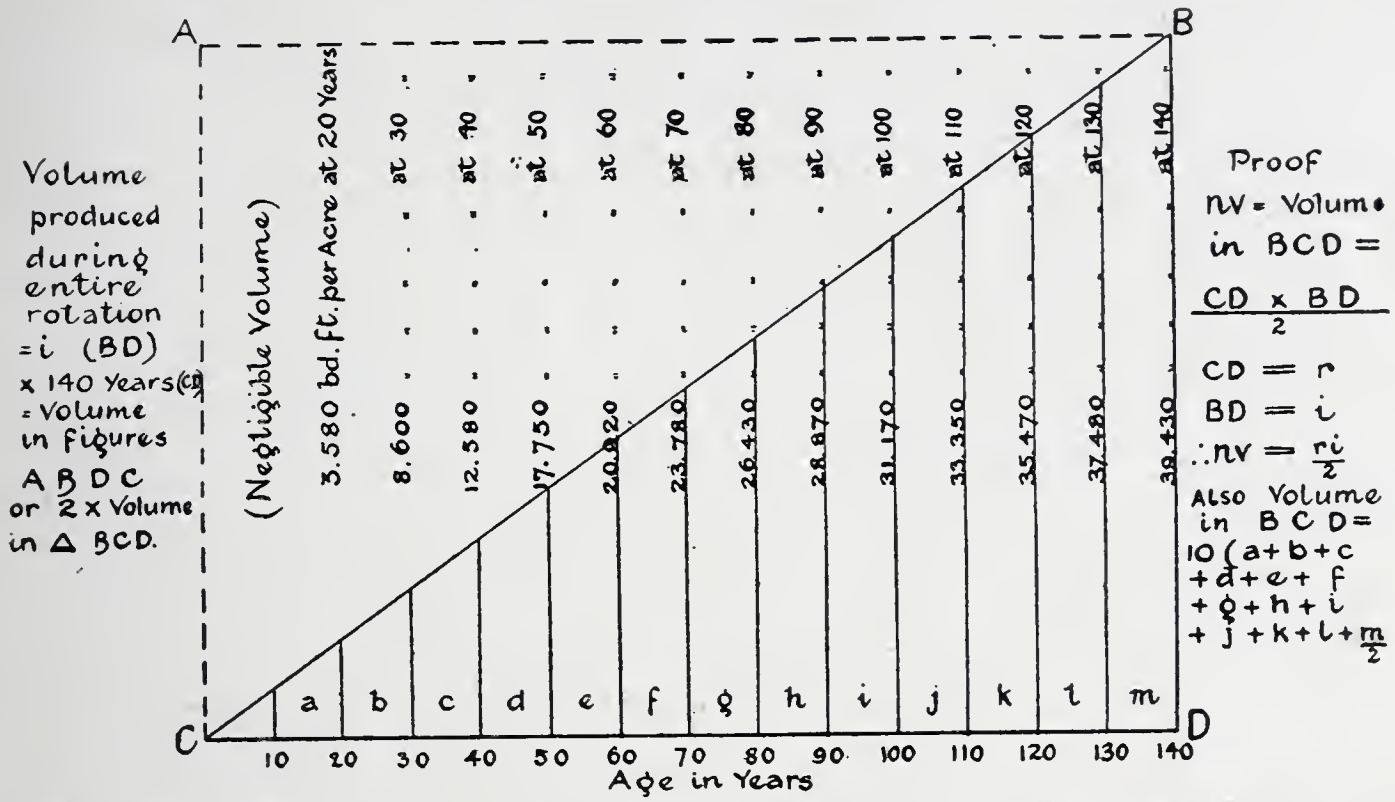
Applying Flury's constant "C" to McCarthy's white pine yields, as given above, the factor is as follows:

For rotation of 30 years, $C = .306$; for 40 years, .365; for 50 years, .378; for 60 years, .421: for 70 years, .452; for 80 years, .475; for 90 years, .493; for 100 years, .507; for 110 years, .518; for 120 years, .525; for 130 years, .536, and for 140 years, .542.

Thus the value for 140 years, given above as 19,715,000 board feet, would be corrected as follows:

$$NV = c \times r \times i = .542 \times 140 \times 281.64$$
$$= .542 \times 39{,}430 \times 1{,}000 \text{ (acres)} = 21{,}371{,}000 \text{ board feet}$$

which compares closely with the value 21,407,000 board feet found by summation of the yield table.



It is obvious that where the constant "*C*" is approximately .5, the error in finding *NV* by the formula method is least, since

$$NV = \frac{ri}{2} = .5 \times r \times i$$

It is also obvious that finding "*C*" and using it in the formula is more correct than applying a general reducing factor, such as found in the case of Douglas fir above.

To further illustrate the workings of "*C*," the average value of "*C*" has been found by and applied to the white-pine yields, as given in table 6, Bulletin 13, U. S. Dept. of Agriculture, for site quality II—*i. e.*, medium site quality. The values by formula, with and without use of "*C*" and by summation of yield table, are also given.

Average Value of Constant "C" in White Pine, Site Quality II, based on Table 6, U. S. Dept. of Agric., Bul. 13.

Rotation (years).	"C."	$NV = \frac{ri}{2}$	$NV = N\left(a + b + c \ldots + \frac{M}{2}\right)$	$NV = c \times r \times i$	Difference between last two columns.
		Feet, board measure, per acre.			
40.....	.227	11,750	5,337.5	5,334.5	3
50.....	.280	18,300	10,280	10,248	32
60.....	.330	23,450	15,525	15,477	48
70.....	.368	28,050	20,764	20,644	120
80.....	.399	32,000	25,588	25,536	52
90.....	.426	35,450	30,239	30,203	36
100.....	.449	38,500	34,610	34,573	37
110.....	.465	41,600	38,745	38,771	26
120.....	.484	44,050	42,654	42,650	4
130.....	.506	45,750	46,280	46,299	19
140.....	.549	47,050	49,604	51,660	56
				Average....	39.4

NOTE.—Values over 100 years from prolonged curves.

The value of Flury's constant in finding the normal growing stock is evident, since, as Flury says,[3] "the normal growing stock is the best, most pregnant, numerical expression of sustained yield management. To attempt an approach to normal stock conditions in some way must be the aim of the manager for sustained yield."

Munger[4] has devised a formula for determining normal growing stock in selection forests. Munger conceives of the normal growing stock as consisting of the reserve left after cutting multiplied by the area, plus one-half the growth, which takes place on the entire forest for the entire cutting cycle. Expressed as a formula:

[3] "Grösse und Aufbau des Normalvorrates im Hochwalde," Mitteilungen der Schweiz. Centralanstalt für das Forstliche Versuchswesen, XI, 1, 1914, pp. 97–148.

[4] Proceedings Society of American Foresters, Vol. X, No. 1, pp. 18–21. The example which Munger gives on p. 20 is for 50 acres, since $\frac{325,000}{50} = 6,500$.

$$NV = \frac{i \times cc}{2} + \text{reserve for the entire forest,}$$

where $i =$ the current annual increment on the entire forest and $cc =$ the cutting cycle (period between cuts).

Example: If for 50 acres $i = 5{,}000$ board feet, $cc = 50$ years—that is, one-fourth of the 200-year rotation and reserve $= 200{,}000$ board feet—then

$$\begin{aligned} NV &= \frac{i \times cc}{2} + \text{reserve} \\ &= \frac{5{,}000 \times 50}{2} + 200{,}000 \\ &= \frac{250{,}000}{2} + 200{,}000 \\ &= 325{,}000 \text{ board feet for the entire fifty acres} \\ &= 6{,}500 \text{ board feet per average acre.} \end{aligned}$$

Using the formula $NV = \frac{ri}{2}$ and the same premises, NV would figure out as 10,000 board feet per acre.

Munger's formula is undoubtedly well adapted for selection forest.

Fischer[5] has suggested the following modification of the formula for normal growing stock when applied to reproduction cuttings:

$$NV = (\text{initial gr. stock} + \text{final gr. stock}) \times \frac{\text{regen. period}}{2} \times .5$$

The last figure varying according to the crown density.

For example: A pine forest which contains on one acre 14,600 board feet at rotation age (160 years) is cut by shelterwood method, so that 66 per cent of the volume is removed during a twenty-year period of regeneration, whereby the density is reduced to .5, substituting:

$$\begin{aligned} NV &= (14{,}600 + 4{,}818) \times \frac{20}{2} \times .5 \\ &= 19{,}418 \times 10 \times .5 \\ &= 194{,}180 \times .5 \\ &= 97{,}090 \text{ for } \frac{20}{2} \text{ years} \\ &= 9{,}709 \text{ board feet for any one year per acre.} \end{aligned}$$

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[5] Allgemeine Forst—und Jagd-Zeitung, March, 1914, pp. 100–102, briefed Forestry Quarterly, Vol. XII, No. 2, pp. 279–280.

By formula:

$$NV = \frac{ri}{2} = \frac{160 \times \frac{14{,}600}{160}}{2} = 7{,}300 \text{ board feet per acre.}$$

Strzeleckis proposes[6] to figure $NV = \frac{r}{2}\left(V\frac{r}{2} + \frac{1}{2}Vr\right)$, where $V\frac{r}{2}$ = volume at ½ rotation age and Vr = volume at rotation age.

Using the data in McCarthy's yield table for white pine, and a rotation of 140 years, $NV = \frac{140}{2}\left(23{,}780 + \frac{39{,}430}{2}\right) = 3{,}044{,}657$ board feet; but this is for 140 acres, for the average acre $= \frac{3{,}044{,}657}{140} = 21{,}748$ board feet per acre, which compares well with NV by yield tables—*i. e.*, 21,407 board feet per acre.

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[6] Allgemeine Forst—und Jagd-Zeitung, 1884, p. 88. p. 316.

HEWN-TIE *VERSUS* SAW-TIMBER ROTATIONS

By Clarence F. Korstian, M. F.,

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A basic silvicultural aphorism indicates that all mature virgin timber should be removed as rapidly as possible. However, because of unusual economic conditions the reverse, the removal of immature timber, is warranted in many cases. Such a condition exists in portions of the Southwest, especially in northern New Mexico, where there is a very limited local market for lumber, but a large cross-tie market. Economic considerations will lead to the establishment of a hewn-tie rotation for parts of the Carson and Santa Fe National Forests. Similar situations no doubt exist on many of the National Forests of the other western districts. A most striking application of this principle is found on and in the vicinity of the Rio Pueblo and Rio Santa Barbara watersheds of the Santa Fe National Forest, on which a detailed study was conducted, the object of which was to determine the class of product, rotation, and cutting cycle to be used in the future silvicultural management of these and similar areas. These data, together with market and lumbering data, will ultimately form the basis for the silvicultural section of the working plan for these watersheds.

Silviculturists differed as to the management of these areas. Some favored a hewn-tie rotation on the assumption that saw timber was more difficult, and therefore more expensive, to exploit than cross-ties, while others maintained that a saw-timber rotation should still be used. Such an economic factor would fundamentally influence the silvicultural management of these watersheds. Little or no saw timber would be left for future cutting if it were considered economically impracticable to log or market this class of product during subsequent rotations, except, of course, fire insurance or seed trees which the silvicultural requirements of the forest demand on tops of ridges and other exposed sites. The rotation and cutting cycle will be adopted which will yield the product having the highest monetary stumpage value, involving a combined technical and financial rotation.

The portion of these watersheds within the National Forest lies on the west slope of the Sangre de Cristo Range at elevations of about 8,000 to 11,000 feet above sea level. The Government timber land on these

watersheds aggregates 41,440 acres, bearing an estimated stand of 18,735 M ft. b. m. of western yellow pine (*Pinus ponderosa*), 32,040 M ft. b. m. of Douglas fir (*Pseudotsuga taxifolia*), 9,395 M ft. b. m. of white fir (*Abies concolor*), 44,350 M ft. b. m. of Engelmann spruce (*Picea engelmanni*), 12,965 M ft. b. m. of alpine fir (*Abies lasiocarpa*), and 725 M ft. b. m. of limber pine (*Pinus flexilis*), besides a small amount of blue spruce (*Picea parryana*) occurring near the streams in the canyon bottoms of the Douglas-fir and subalpine types.

The aim of the writer, in treating this subject, has been to promulgate a simple silvicultural procedure devoid of lengthy mathematical limitations. A statement of some of the salient characteristics of the principal species and forest types will doubtless add clearness to the basic conclusion reached regarding the silvicultural management of these watersheds.

FUNDAMENTAL SILVICAL DATA

Reproduction

A study of the comparative height growth of western yellow-pine, Douglas-fir, white-fir, Engelmann-spruce, and alpine-fir seedlings indicated that the more open the type in which a species naturally grows the more rapid the height growth, and that the more tolerant species grow slower than do their less tolerant type associates. This is caused largely by the intense competition which the tolerant species must endure during youth, or until the stand is opened sufficiently to allow them to grow out of their suppressed condition. The intolerant species die if suppressed, and consequently cannot enter into keen competition.

An average of 276 seedlings and saplings per acre shows that ample advance reproduction is present in most of the western yellow-pine type. Approximately 80 thrifty poles per acre is sufficient to insure the future of the forest and to guarantee cutting during the whole of the next rotation. The good seed year and hewn-tie cutting of 1913, followed by favorable climatic conditions in 1914, resulted in innumerable seedlings, which is especially gratifying in view of the fact that the saw timber on the type is now being logged. This indicates that, with a combination of a good seed crop, followed by favorable climatic conditions, ample natural reproduction can be expected. It is significant that much of the advance reproduction has come in under conditions closely approaching those which obtain in a forest managed under the selection system. Western yellow-pine seedlings occasionally start under the partial shade of open stands, but more frequently in groups in the small openings between groups of large trees, thus perpetuating the group-forming habit

of the species. The growth and development of seedlings under partial shade is slower than in the open. Western yellow pine makes its best development in practically full sunlight, provided sufficient soil moisture is available. The requisite amount of soil moisture is best assured by the protection against excessive heat, evaporation, and transpiration afforded the seedlings by the partial shade of the trees in the neighboring groups. Natural regeneration may be difficult only on the dry, rocky south slopes and on areas covered with oak brush. Occasionally it may be necessary to resort to artificial regeneration on some of these areas. The western yellow-pine type as a whole is well stocked with reproduction, and cutting in this type is, therefore, decidedly opportune.

An average of 319 Douglas-fir and 618 white-fir seedlings and saplings per acre shows that sufficient advance reproduction is present in the Douglas-fir type to perpetuate the forest during the next rotation. The small proportion of Douglas-fir reproduction in this type is due to the greater seed production and less exacting silvical requirements of the aggressive white fir. Under the partial shade of a mature stand Douglas-fir seedlings are capable of growing slowly for a long time, and when the stand is opened moderately they are able to make rapid growth, especially if on fresh mineral soil. The fact that Douglas fir reproduces better in moderate openings than white fir indicates that, other conditions being equal, a moderate opening of the stand favors the regeneration of Douglas fir. Aspen stands growing on old burns usually afford exceptionally favorable soil, moisture, and light conditions for the good growth and development of Douglas fir. Ample reproduction can be expected if the stand is so cut that the conservation of the surface-soil moisture is assured.

The advance reproduction of the subalpine type is composed of approximately 150 Engelmann-spruce and 2,497 alpine-fir seedlings and saplings per acre. The high percentage of alpine fir is accounted for by the facts that all of the stands studied were very dense and that alpine fir is less exacting as to seed-bed requirements and is more tolerant than Engelmann spruce. It is a significant fact that Engelmann-spruce seedlings were found on every one-fortieth acre plot studied, indicating that the present advance reproduction is uniformly, but not fully, restocking the type. Bates[2] has shown that where Engelmann spruce and alpine fir are present in the original stand Engelmann-spruce reproduction predominates where the crown density is less than .5, while

[2] Bates, C. G. "Silvicultural Systems of Management for Central Rocky Mountains." Proceedings of the Society of American Foresters, 7: 106-116, 1912.

alpine-fir reproduction predominates under a crown density of more than .5. Engelmann-spruce reproduction is favored by a moderate opening of the stand which permits an increased amount of light to enter. This stimulates the decomposition of the humus, in turn exposing the mineral soil. The suppressed reproduction is released by lumbering, and its growth thereby stimulated. From the standpoint of reproduction, the chief factors to consider in formulating a marking policy for the subalpine type are the moderate opening of the stand, the exposure of mineral soil, and the conservation of the surface-soil moisture.

Stand

The average acre in the western yellow-pine type was found by strip valuation surveys to contain approximately fifty-seven 4 to 9 inches, forty-three 10 to 17 inches, and ten western yellow-pine trees 18 inches and over. The Douglas-fir type contains an average of approximately thirty-one 4 to 9 inches, twenty-one 10 to 17 inches, and five Douglas-fir trees 18 inches and up per acre, and forty 4 to 9 inches, eighteen 10 to 17 inches, and five white-fir trees 18 inches and over per acre. The average acre of the subalpine type contains approximately forty-eight 4 to 9 inches, thirty-two 10 to 17 inches, and six Engelmann-spruce trees 18 inches and over, and one hundred and thirty-two 4 to 9 inches, twenty-seven 10 to 17 inches, and two alpine-fir trees 18 inches and over; also twelve 4 to 9 inches, thirteen 10 to 17 inches, and three Douglas-fir trees 18 inches and over. Rather significant differences were noted in the distribution of the types, caused principally by changes in exposure. In the western yellow-pine type, even toward the lower limits of the type, a northern exposure frequently has a stand of Douglas fir and white fir, while a south exposure near the upper limits of the Douglas-fir type will often have a fair stand of western yellow pine, and even occasionally piñon (*Pinus edulis*) and mountain red cedar (*Juniperus scopulorum*) scattered through the oak brush (*Quercus gambelli*).

Growth

The climatic and soil conditions are such in the southern Rocky Mountains that none of the commercially important species make rapid growth. Table 1 gives the diameter and age of black-jack, yellow pine, Douglas fir, white fir, Engelmann spruce, and alpine fir at different stages of development. It is significant that the yellow pine when in the black-jack form grew slower than the present black-jack of the same size. Woolsey[3] noted the same difference, and attributed it to the stim-

[3] Woolsey, T. S., Jr. "Western Yellow Pine in Arizona and New Mexico." U. S. Dept. of Agriculture, Forest Service Bulletin 101, pp. 22-23, 1911.

ulation of diameter growth of the more recent black-jack forests due to being thinned by fire. White fir apparently makes considerably slower growth than is generally attributed to this species. Engelmann spruce is persistent in its growth, and is able to outstrip its most common associate, alpine fir, beyond one hundred years. It is gratifying to note that the more desirable species surpass their type associates in growth at some time in the intermediate age classes, thus assisting the forester in his attempt to favor the more valuable at the expense of the less desirable species. All of the species considered pass the period of maximum diameter growth before they attain the age of one hundred years.

TABLE 1.

Comparative ages of black-jack, yellow pine, Douglas fir, white fir, Engelmann spruce, and alpine fir on basis of diameter breast high.

Diameter breast high outside bark (inches).	Age (years).					
	Black-jack (basis 123 trees).	Yellow pine (basis 36 trees).	Douglas fir (basis 86 trees).	White fir (basis 67 trees).	Engelmann spruce (basis 61 trees).	Alpine fir (basis 32 trees).
4	35	45	53	58	54	54
6	46	57	69	75	66	66
8	58	70	86	91	78	78
10	73	86	103	110	93	93
12	94	107	123	137	109	112
14	120	135	146	168	129	136
16	149	167	167	197	154	164
18	179	199	185	226	184	193
20	210	230	200	256	.....	.....
22	240	261	215	.....	.....	.....
24	270	292	232	.....	.....	.....
26	.....	322	250	.....	.....	.....
28	.....	353	268	.....	.....	.....
30	.....	384	288	.....	.....	.....

Yield

The commonly accepted method of studying the yield of all-aged stands by means of the current increment of the different diameter classes was employed. Tables were constructed predicting for the next four decades the empirical yield in feet board measure and number of ties per acre of black-jack, yellow pine, Douglas fir, white fir, Engelmann spruce, and alpine fir, which are summarized by types in Table 2. These were constructed by applying the previous decade growth data for individual trees to the number of trees of each diameter class composing the

stand on the average acre marked for cutting, as shown by tabular statements of marking compiled for each type after making reductions of from 5 to 8 per cent for the western yellow-pine and Douglas-fir types and 6 to 12 per cent for the subalpine type to cover the probable mortality. Tables showing the empirical decade yields of ties under different degrees of cutting were constructed for the western yellow-pine, Douglas-fir, and subalpine types. The western yellow-pine type in 10 years should, theoretically, yield 45 ties per acre cutting to a diameter limit of 12 inches, or 25 ties if a cutting limit of 14 inches were used. In 10 years the Douglas-fir type should yield 34 ties per acre with a 12-inch cutting limit, or 17 ties under a cutting limit of 14 inches, considering white fir merchantable. If white fir does not become merchantable again, the Douglas-fir type will yield only 10 ties in 10 years, 14 ties in 20 years, and 22 ties in 30 years if cut to a 14-inch limit. The subalpine type should yield 40 ties per acre in 10 years if cut to a limit of 12 inches, or 23 ties when cut to 14 inches.

TABLE 2.

Predicted empirical decade yield per acre in ties as compared with saw timber for the western yellow-pine, Douglas-fir, and subalpine type.

Decade.	Western yellow-pine type.		Douglas-fir type.[1]		Subalpine type.	
	Number of ties.	Saw timber, feet b. m.	Number of ties.	Saw timber, feet b. m.	Number of ties.	Saw timber, feet b. m.
1915	52	3,751	59	3,339	97	7,018
1925	66	2,812	52	1,979	95	3,472
1935	102	3,630	73	2,552	165	5,467
1945	136	4,977	92	3,573	282	9,408
1955	182	5,939	150	5,388	445	14,842

[1] Considering white fir unmerchantable, the yields would be: 1925, 27 ties, or 1,044 feet b. m.; 1935, 37 ties, or 1,436 feet b. m.; 1945, 49 ties, or 2,010 feet b. m.; 1955, 71 ties, or 2,858 feet b. m.

Instead of comparing the yield in board measure and ties for an entire saw-timber rotation, the comparative yields during the next four decades were considered, because this was deemed less hypothetical than for a 200-year period. Applying the stumpage values of $0.86 per M feet b. m. for saw timber and $4.07 per M feet b. m. for ties, as computed below, to the yields during the 40-year period, it is calculated that the yield of the western yellow-pine type in hewn ties will be worth approximately $22.20 per acre, compared with $5.11 for saw timber. The hewn-tie yield of the Douglas-fir type should be worth approximately

$18.30 per acre, compared with $4.59 for saw timber during the same period, considering white fir merchantable. If white fir remains unmerchantable, the yields will only be worth approximately $8.66 per acre for ties, or $2.06 for saw timber. The value of the hewn-tie yield of the subalpine type for the four decades should approximate $54.29 per acre, compared with $12.76 for saw timber. The volume yield in feet board measure will be somewhat greater as saw timber than as hewn ties. The great differences in the financial yield are caused by the much higher monetary stumpage value of the 10 to 17 inch trees for hewn ties than of the larger trees for lumber and sawn ties.

SILVICULTURAL MANAGEMENT

Exploitation and Utilization

General.—Since cutting has been in progress on the lower Rio Pueblo Logging Unit for approximately three years, and the same concern has been operating on private holdings on this and the adjacent Rio Santa Barbara watershed for the past seven or eight years, useful cost and appraisal data are now available for the stumpage of these watersheds.[4] A good opportunity is afforded for an economic comparison between exploiting the stand as saw timber for lumber alone, for sawn ties and side lumber, and exploiting it solely as tie timber for hewn ties, or in a combined hewn and sawn tie cutting. It is true that, because of silvicultural and lumbering reasons, the next cut will necessarily be a combined hewn and sawn tie cutting similar to the present one, but with more hewn-tie timber and less saw timber. Douglas fir is fully as valuable as western yellow pine for lumber, timbers, and ties, but white fir at present is considered unmerchantable on these areas. However, when the more accessible timber of the region is logged and a better means provided for fastening the rail to the ties, it is believed that white fir will again become merchantable.

Stumpage Appraisals.—The appraisals of the estimated value of the stumpage under different forms and combinations of manufacture and utilization are summarized as follows:

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[4] Korstian, C. F. "Exploitation of Cross-ties in Northern New Mexico." Forestry Quarterly, 12: 408-424, 1914. Supplementary data were also collected by Forest Ranger Wayne Russell.

Form of utilization.	Products.		Average stumpage value per M ft. b. m., log scale.
Saw timber....	100% lumber at $0.50 per M.....		$0.50
Saw timber....	65% sawn ties, 35% side lumber, at $0.86 per M.....		.86
Saw timber....	52% sawn ties, 28% side lumber, 80%, at $0.86 per M.....	$0.69	
	20% hewn ties from tops at $4.05 per M.	.81	
			1.50
Hewn-tie and saw timber.	36% sawn ties, 19% side lumber, 55%, at $0.86 per M.....	.47	
	15% hewn ties from tops at $4.05 per M.	.61	
	30% hewn ties—trees 11 to 17 inches d. b. h.—at $4.07 per M.....	1.22	
			[5]2.30
Hewn-tie and saw timber.	20% sawn ties, 10% side lumber, 30%, at $0.86 per M.....	.26	
	10% hewn ties from tops at $4.05 per M.	.40	
	60% hewn ties—trees 11 to 17 inches d. b. h.—at $4.08 per M.....	2.44	
			[6]3.10
Hewn-tie timber.	100% hewn ties at $4.07 per M.....		4.07

[5] This figure closely approximates the stumpage value under the present methods of operation, since these were used in the determination.

[6] This estimate is based on the presumption that at the next cut the number of hewn ties will be doubled, and that 60 per cent of the timber marked for cutting can be hewn into ties.

From an economic standpoint the above data need no explanation. It is evident that utilization as hewn ties is by far the most profitable operation, and will yield the highest stumpage returns. This operation requires little investment or supervision, and much of the expense can be paid through the commissary. Saw timber requires a manufacturing investment and more experienced labor. The management of these areas on hewn-tie rotations is fully justified from an economic consideration, because of the higher stumpage value caused by the higher selling price of hewn ties and the higher cost of production of other classes of material. The latter is principally due to the high and, in some cases, prohibitive cost of delivery on board cars or at market which is occasioned by the long wagon haul necessary for lumber and other products of large dimensions. A logging railroad from the cutting areas to the common carrier railroad is economically impracticable, because of the formidable engineering undertaking and the attendant high construction and maintenance costs, with little or no traffic aside from the timber. Cross-

ties and other small products only can be driven in the streams of this region because of their small size and the volume of their flow. Little concern need be had as to the present or any other operators monopolizing the drivable streams. The New Mexico act of March 18, 1907,[7] was enacted to regulate logging and prescribe rights of the use of streams in driving logs and other forest products in the State of New Mexico.

In the above summary it will be noted that, as the percentage of side lumber decreases and that of hewn ties increases, there is a corresponding increase in the stumpage value. This factor is even more important than the rate of growth in determining the most profitable financial rotation. The rotation should, therefore, be adopted which will produce the most desirable hewn-tie trees, and all timber not needed for silvicultural purposes should be utilized if suitable for hewn ties. The main object in the silvicultural management of this area should, therefore, be to stimulate the production and utilization of hewn-tie timber.

It would be very desirable, from the standpoint of closer utilization, before the next cut is made to develop a market for mine props made from the tops of hewn-tie trees. Aside from increasing the net receipts this would, however, have little effect on the stumpage value at the time of the next cut, which, it is estimated, should be worth approximately $3 per M feet. The succeeding cut should bring $4 per M feet under similar economic conditions. No further change in stumpage value is anticipated unless occasioned by a change in economic conditions, since the watershed should then be on a hewn-tie rotation.

Cutting Cycle

An approximate minimum diameter cutting limit of 14 inches breast high has been selected because 14 and 15 inch trees are considered the optimum tie trees. Trees less than 14 inches d. b. h. yield no square ties and few firsts. A wider margin of profit can be realized on the exploitation of first ties than on seconds. It is therefore desirable to increase the number of firsts and decrease the number of seconds in the succeeding cuts. A variable cutting limit should be maintained. Few, if any, 14 and 15 inch 2-tie sound, healthy trees should be marked, while 3 and 4 tie 13 and 14 inch trees can be marked, especially in crowded stands. A yield of 20 ties per acre is deemed sufficient to warrant a hewn-tie operation, in view of the fact that no expensive road construction will be necessary, since the existing tie roads can be improved at a small cost. A study of the empirical yields of hewn ties indicated that under a hewn-tie rotation, with a diameter cutting limit

[7] New Mexico Statutes, Annotated (1915), Secs. 3371-3377.

of 14 inches, a cutting cycle of 10 years can be maintained for the western yellow pine and subalpine types. The cutting cycle for the Douglas-fir type depends upon the future merchantability of white fir. Should white fir again become merchantable, the next hewn-tie cut can be made in 20 years, after which cuttings can be made every 10 years, while if it remains unmerchantable a period of approximately 30 years must elapse before a per-acre yield of 20 ties can be secured, after which time cuttings can be made every 15 to 20 years. Every effort should be made to cut the tie timber when it is ready for the axe, which is in direct accordance with the technical tendency to favor short cutting cycles.

The saw timber now remaining on the areas should be cut as soon as the present growing stock, together with its increment, has attained a sufficient volume to warrant a practical sawn-tie proposition. A minimum of 2,000 M feet b. m. should be available for each mill set, and should not be distributed over more than 2,000 acres, which requires 1,000 feet per acre. It is true that most of the logging roads have already been constructed, but most of them will require extensive improvements by the time of the next saw-timber cut. A study of the empirical yield in board measure of the trees 18 inches and over indicated that the remaining saw timber may be profitably cut in 30 years in the western yellow-pine type, in 40 years in the Douglas-fir type, and in 50 years in the subalpine type. The length of time elapsing before the next saw-timber cut on any given logging unit will be determined by the time required by the most abundant and important type on that unit.

Rotation

Preliminary forest organization requires the establishment of a rotation. From the data presented above it is apparent that hewn-tie rotations should be adopted for these watersheds. As previously shown, the diameter-cutting limit should be placed at or near 14 inches breast high. Since 120 years is required for black-jack to reach a breast-high diameter of 14 inches, a hewn-tie rotation of 120 years was tentatively suggested for the western yellow-pine type. In the Douglas-fir type 14-inch trees are grown in about 150 years, thereby placing the rotation at 150 years. The subalpine type can be managed on a 130-year rotation. The proposed rotations seemingly presuppose that the new stands will be established the first year of the new rotation, since no apparent allowance is made for a period of regeneration, but, on the other hand, the abundant advance reproduction uniformly present on the areas is considered more than sufficient to offset the possible delaying of the rotation due to the

inability of natural reproduction to fully restock the stands at once. Most of the mature saw timber which is now being lumbered is from 250 to 400 years old. However, the growth data indicate that western yellow-pine saw timber can be grown in 250 years and Douglas fir and Engelmann spruce in 200 years. The diameter growth begins to decline considerably even before the recommended rotations have elapsed. With thrifty, well-thinned stands the accelerated growth after cutting will, no doubt, be considerable, thereby perceptibly shortening the rotations.

It will doubtless be inadvisable to attempt to establish rotations of different lengths for the different species or forest types, since, when cutting is initiated on a certain area, all merchantable species on the entire logging unit must be cut. A separate rotation should be established for each logging unit, the length of which to be determined by the principal species or type.

The recommended hewn-tie rotations are based upon present market conditions. It would be a simple silvicultural operation to shift from a hewn-tie to a saw-timber rotation, should such a change become desirable at some future date, by suspending cutting operations for a period sufficient to allow the small-tie timber to grow to saw-timber size, a far easier change than from a saw-timber to a hewn-tie rotation.

Marking

The marking must be varied within each type to meet the silvicultural requirements of the forest. The basic principles, such as the silvics of the species, exploitation and market conditions, the fire hazard, and the removal of the decadent, unhealthy, and overmature timber as rapidly as possible, to avoid waste through decay, must be fully taken into consideration under any rational method of cutting.

The western yellow-pine type and part of the Douglas-fir type was marked with the idea of making a saw-timber cutting in about 50 years and then managing the area on a hewn-tie rotation. Another saw-timber cutting will be necessary to remove the saw timber now above tie size. At this time all timber above tie size which is not absolutely needed for silvicultural purposes should be marked. The few trees above tie size which are reserved for silvicultural purposes will probably not warrant further saw-timber cuttings, and, when mature, can be utilized for split ties.

The marking of hewn-tie timber resolves itself into a selection cutting to a flexible diameter limit of approximately 14 inches. Larger trees will occasionally be needed for seed production, fire insurance, or to maintain the proper stand density, while 3 and 4 tie 13 and 14 inch trees in

moderately closed stands and all defective, diseased, and suppressed trees should be marked unless silviculturally needed. The diameter limit should by no means be rigidly adhered to. This elasticity will give practically the same yield as though the cutting were confined to a rigid diameter limit of 14 inches d. b. h. When these watersheds are placed on hewn-tie rotations, the marking will be rather unique in that most of the timber will be cut when young and thrifty, the time at which its prime is reached, and in the case of the western yellow-pine type small, sound, healthy black-jack will be marked for cutting, which has been a very unusual policy for this type in the Southwest, as the original marking policy prescribed the leaving of all healthy black-jack except when in need of thinning.

Care must be exercised in handling western yellow-pine stands to avoid the creation of openings larger than one-fourth acre and the enlargement of existing openings.

Most of the virgin Douglas-fir type consists of mature Douglas fir and white fir over a reproduction composed chiefly of white fir. Here it would be desirable to favor Douglas fir at the expense of the white fir—that is, cut Douglas fir to the optimum tie diameter and white fir to the lowest diameter at which it is merchantable, normally 10 inches d. b. h. Unfortunately, however, white fir is at present unmerchantable, but there is reason to believe that it will again become merchantable in the not distant future. Since it is desirable from the standpoint of the silvicultural efficiency of the forest that white fir be removed, the Forest Service should make every effort to secure its utilization, though no profit is realized. Since the present market conditions render white fir unmerchantable, the cutting in the near future will be confined to Douglas fir, and should take the form of a selection cutting to a diameter limit of approximately 14 inches. It will be advisable occasionally to leave groups of seed trees as a protection against a general conflagration.

Engelmann spruce should be favored in the subalpine type. From the standpoint of lumber production, alpine fir is inferior to Engelmann spruce. The same inferiority holds true to a less extent from the crosstie standpoint. Engelmann spruce is stronger, clearer, and less defective than alpine fir. The eradication of the alpine fir will naturally be a slow process. The first effect of cutting will release the suppressed advance reproduction, which is principally alpine fir. After the first operation which opens the stand, admitting more light, and by baring the mineral soil of litter, in many places a seed-bed favorable to Engelmann spruce is prepared. The proportion of spruce reproduction should be increased by each subsequent operation. As future operations continue to remove more fir and favor the spruce, it is not difficult to anticipate

the time when Engelmann spruce will predominate, especially in view of the fact that alpine fir possesses a higher mortality and is shorter lived, not reaching as large dimensions as Engelmann spruce.

In subalpine stands, where ample advance reproduction is already present, a modified system of strip felling was attempted experimentally. Strips 2 to 4 chains wide were reserved for seeding purposes and for protection in case of fire. They were left near the tops of ridges, and extending down to the windward of the area clear cut. The area cut clean was between 5 and 10 chains in width. The series was repeated as often as necessary to cover the area on which ample advance reproduction was present. This system is not logical, because, in addition to the danger of the soil drying out, the government is very apt to lose, as a result of clear cutting, many small, thrifty trees capable of rapidly developing into more desirable material under another method of silvicultural management. At the same time many large, slow-growing trees which, if not already deteriorating, will soon be in such condition are left in the seed strips. This does not seem to be the best method, even for areas on which ample advance reproduction is fully established. For an Engelmann-spruce forest, managed on a hewn-tie rotation, a form of selection cutting to a variable diameter limit of approximately 14 inches d. b. h. is more desirable. Alpine fir should be cut to the lowest merchantable limit when it can be safely cut without creating openings in the stand.

The selection system is also more favorable to watershed protection, because it does not impair the continuity of the forest. The Rio Pueblo and Rio Santa Barbara watersheds are within the zone of heavy rainfall and accumulating snows, upon which rather important agricultural interests are dependent. Both rivers are permanent streams tributary to the Rio Grande, a river of great importance to large irrigation projects in New Mexico. Watershed protection, therefore, has special significance on these areas.

In all types the marking should be light on exposed sites and along scenic highways. On such areas it is doubtful if the 14-inch diameter limit can be maintained. A defective or diseased tree should not be left if it will not last until the next cutting, unless it is badly needed for silvicultural purposes. When it becomes necessary to reserve insurance or seed trees among the larger diameters, thrifty trees of good form should be chosen for seed production, since form is influenced by heredity as well as by soil and climate.[8] In short, the chief fundamentals of silviculture

[8] Engler, Arnold. Einfluss der Provenienz des Samens auf die Eigenschaften der forstlichen Holzgewächse. Mitteilungen der Schweizerischen Centralanstalt für das forstliche Versuchswesen, Zurich, 1905, Vol. 8: 81-236; 1913, Vol. 10: 1-386. Reviewed in Proceedings of the Society of American Foresters, 9: 107-113, 1914.

to be applied in marking on these watersheds are to maintain the continuity of the forest, favor the more valuable species, and to increase the productivity of the forest.

Protection from Disease

In formulating a management policy for any forest the pathological aspect should be considered. To determine the amount of commercial loss due to rot, a typical area of approximately 30 acres was studied by the writer. The area yielded 77,290 feet b. m. of sound material and 14,580 feet b. m., or 15.4 per cent, of cull, by far the greater portion of which was due to western red rot, probably *Polyporus ellisianus*. Long[9] found that there is a marked difference in the percentage of black-jack and of yellow pine infected with western red rot. An average of 20 per cent of the yellow pines showed western red rot in some portion of the bole, while the black-jacks showed only 1 to 2 per cent. The black-jacks infected with rot were either suppressed or were growing under unfavorable conditions. All such trees should be marked for cutting when possible, not only on account of their susceptibility to rot, but also because they will never become thrifty, rapid-growing trees.

Black-jack is practically immune from rot, but as the trees grow older and change to yellow pines, the increasing number of dead branches present render them more susceptible to infection by rot-producing fungi. Butt rot, caused by *Polyporus schweinitzii* is also more prevalent in the older trees. White fir is very susceptible to attacks of the Indian paint fungus (*Echinodontium tinctorium*), and trees above 20 inches d. b. h. are seldom sound. White fir, therefore, should be cut whenever possible.

On these watersheds western yellow pine from 125 to 150 years old (14 to 16 inches d. b. h.) is very rarely attacked by heart-rotting fungi, while trees 200 to 250 years old (20 inches or over in diameter) bear a much higher percentage of rot. It is fundamentally true that the older the tree the more liable it is to infection by heart-rotting fungi. Any method of regeneration which will remove the older yellow pines and most of the larger black-jacks, as well as the suppressed trees, is desirable. It follows, then, that the shorter the rotation, consistent with rational silviculture, the more free the forest will be from disease.

CONCLUSIONS

1. The present improvement cutting is fully justified from the standpoint of silvicultural management, since the removal of much overmature and surplus growing stock is being secured.

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[9] Long, W. H. Manuscript memorandum on "Defects (rot) Found in Timber on the Rio Pueblo and Rio Santa Barbara Watersheds, Pecos National Forest," December 31, 1914.

2. All of the commercially important forest types on the Rio Pueblo and Rio Santa Barbara watersheds of the Santa Fe National Forest should be managed on hewn-tie rotations, because tie timber is worth over $2 per M feet b. m. more than saw timber on these watersheds. A modified form of the selection method should be used in the silvicultural management of these areas. A flexible diameter-cutting limit of approximately 14 inches should be adhered to, because 14 and 15 inch trees are the optimum-sized tie trees.

3. Tentative rotations of 120 years for western yellow pine, 150 years for Douglas fir, and 130 years for Engelmann spruce are recommended for the logging units dominated by these species. They have passed the period of maximum accretion before the above ages have been attained. The mortality per cent is smaller in a short rotation. A short (hewn-tie) rotation is also more desirable from the pathological standpoint.

4. The western yellow-pine and subalpine types can be managed on cutting cycles of 10 years. The cutting cycle for the Douglas-fir type depends upon the future merchantability of white fir. Should white fir again become merchantable, the next hewn-tie cut can be made in 10 years, while, if it remains unmerchantable, a period of approximately 30 years must elapse before a per-acre yield of 20 ties can be secured, after which cuttings can be made every 15 to 20 years. Under the above cutting cycles a sustained yield of at least 20 ties per acre can be expected at each cutting. The principal species or forest type will determine the cutting cycle for each logging unit.

5. The remaining saw timber in the western yellow-pine type can be profitably logged in approximately 30 years, that in the Douglas-fir type in approximately 40 years, and that in the subalpine type in approximately 50 years, the exact time to be determined by the principal species or type, after which time no more saw-timber cuts are contemplated. The small amount of timber above hewn-tie size which will accumulate can be worked into split ties when mature.

6. The future watershed protection of these areas is secured by the extent and character of the forest cover which is left, provided that adequate fire protection is maintained. The importance of the fire plan cannot be overemphasized.

FOREST TAXATION
AS A FACTOR IN FOREST MANAGEMENT[1]

By G. W. Hutton, Forest Assistant, Olympic National Forest, and
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It has been well understood by lumbermen for some time that the standing timber, especially on the Pacific coast, is being taxed in a manner which is entirely inconsistent with the principles of proper utilization of the forests, or even sound business, to say nothing of the principles of forestry. Especially the large timber-holders feel the necessity of a change in the forest taxation policy in order to prevent confiscation of part of their holdings or throwing upon the market a product, the supply of which already outweighs the demand. This is contrary to the principles of economics, and in the long run the public is a heavier loser than the individual, for the useless destruction of timber means the ultimate loss of a public necessity.

Owing to the many expenses connected with the holding of timber, which are out of proportion with the increase in values of wood products, many articles have been written in connection with a reform in timber taxation. It is the purpose to show by counties the taxes for the State of Washington in 1914, as well as other information concerning the taxation of forest lands and forest products.

The question of applying a yield or income tax in preference to the present property tax to the forests of the State of Washington is a matter of vital concern to those engaged in the business of lumbering and forestry. Its bearing on forest management is presented in solving the problem of excessive carrying charges, causing heavy cutting, low percentage of utilization, and overloading of a weak market, and likewise in the disposition of forest land after logging. The detailed study of the tax problem in the State of Washington, as carried on by Messrs. F. G. Miller and F. B. Kellogg in 1911, brought out many points on this question, one of which was that private timber owners admitted that they had to sacrifice their holdings in order to meet the tax burden. Further discussion on this point has made the subject a leading one in western forest matters.

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[1] Based on study of present tax methods in the State of Washington. The views expressed in this article do not in any way represent the official views of the Forest Service on the question of forest taxation; they are only the personal views of the authors and are given here as such.

The present method of taxing timber holdings in this State has been severely criticised by tax experts. Prof. F. R. Fairchild, of Yale University, has pointed out the fallacies of the present system. Investigations show that the present method of taxing timber as if it were a mine, which, after cutting operations, would be exhausted, rather than on the crop idea, is fundamentally wrong, and should be changed. This is the universal opinion of the parties directly interested. Of the proposed tax systems to replace the present one, the yield, or income tax, with an annual charge on the raw-land values, offers good possibilities.

In the application of a yield tax to timber many problems of adjustment must be given due attention. One which is promptly suggested is the method of readjustment in those counties whose timber holdings are inaccessible or held in large tracts for speculative purposes. Some counties would be cutting beyond their normal cutting limits, and the exhaustion of their timber holdings would be a matter of early speculation. Other counties would show a very small annual cut, and, because of the large amount of timber in the county, would be heavily dependent upon the timber revenues to meet their present expenses.

The ideal system for forest taxation would be a yield tax, with the forests of each county under sustained annual, rather than periodic, yield management. This would involve the classification of all forest lands in each county, with the view of determining the area and possible yields of the forest. The annual cut would be established, and the taxes could be predicted far in advance. Utilization would necessarily be closer, because the economic considerations would demand it. The present butchering process would not be necessary, because the tax laws would be framed to encourage proper cutting of logical logging units. This is not to infer that the system would require considerable inspection and enforce the taking out of cull logs or unmerchantable material. It does presume that land which has been classified as permanently of greatest value for forest production, after cutting, will become stocked with forest growth of the best adapted species, and with protection from fire there will be an equivalent volume ready for harvest at the end of the present cutting period.

The present tax methods take no consideration of the future management of forest lands. Some of the tax assessors have made the statement that they were at a loss to understand from where the revenue would be derived after the present stand of timber is removed. This is especially true of the Olympic Peninsula counties, where timber pays over half of the annual tax bill. Promptly placing these forested counties under

forest management and changing the tax laws to make this possible, would insure a permanent form of revenue to those counties which are greatly dependent on timber for a source of income to meet their annual expense.

From the present estimated total stand of timber in this State and the present rate of cutting, it can be easily inferred that there is sufficient timber to last for over sixty years. The rate of cutting has increased from four to six billion feet during the last four years. The activity of the lumber associations in market extension through advertising, use of odd lengths, department store lumber stocks, treating of wood for paving and other purposes, is expected to have a stimulating effect on the activity of lumber in trade markets. This means directly that the large bodies of virgin timber in the State, which will be made accessible as soon as the trade warrants, will be cut rapidly, and the total cut for the State increased rather than held at the present level. There is sufficient timberland in the State to warrant the present annual cut, and, under management, the cut could even be increased; but there has been no effort, except on the National Forests, to insure an annual cut which would be stable.

Making permanent the annual cut, in accordance with the capacities of the forest land, means the stabilizing of industries and the concentration of effort towards the fullest use of the land for the purpose to which it is best adapted. The sight of the vast areas of logged-off land capable of supporting well-stocked stands of timber lying idle has caused much discussion of the subject. Its vital bearing on the lumbering industry can be seen in the inroads of substitutes. The impression that the wood supply of the nation was limited gave food for the advertising of substitutes. People were led to believe that wood was a temporary product in this country, and that it was getting expensive because of its scarcity. A perpetual supply of timber is essential to the prosperity of the country. Forest management is necessary for the perpetuation of the lumber industry, and a proper tax law is necessary to allow the practice of forest management.

Contrast the present sight of barren logged-off lands with the same areas stocked with dense young stands of the better species, which would have regular age gradations, and a stocking sufficient to shade off many of the lateral branches at an early date so as to develop smooth boles with high percentages of better grades of lumber. This is no Utopian idea, for it is a matter of common knowledge that the foresters of European countries, and of some of the more progressive of the Eastern States, have

placed their forests under management, and thus insured a regular allotment of the annual increment.

There are many areas of logged-off land in the State on which "accidental forestry" has taken place. Nature, in spite of the wishes of the owners, has established well-stocked stands on many of the cut-over lands, and, with protection from fire, these young forests have done remarkably well.

The figures presented in the following table show the importance of timber as an object of taxation in the counties west of the Cascade Mountains in the State of Washington:

Taxes Levied in 1914—Counties West of Cascade Mountains.

Counties.	Total tax levy, 1914.	Taxes paid by timber products exclusive of land.	Taxes paid on timberland.	Total timber taxes.	Ratio of timber taxes to total tax levy.	Total rate of levy.
	Dollars.					*Mills.*
Grays Harbor	1,292,369	609,100	65,150	674 250	.52	.0308
Clallam	422,582	202,330	89,165	291,495	.69	.0289
Clarke	628,716	8,230	12,400	20,630	.03	.0414
Cowlitz	397 546	142,495	35,405	177,900	.45	.0415
Island	94,636	13,260	7,300	20,560	.22	.0481
Jefferson ...	287,465	97,245	48,750	145,995	.51	.0422
King	10,764,465	100,260	193,775	294,035	.027	.0396
Kitsap	301,746	11,900	23,665	35,565	.11	.0469
Lewis	922 025	257,605	117,400	375,005	.41	.0451
Mason	219,237	118,495	26,930	145,425	.66	.0391
Pacific	570,999	202,795	91,385	294,180	.51	.0395
Pierce	3,474,242	55,120	231,195	286,315	.08	.0355
San Juan...	56,379	60	.....	60	.001	.0355
Skagit	826,935	81,470	81,310	162,780	.20	.0573
Skamania ..	141,864	14,210	29,550	43,760	.31	.0326
Snohomish .	1,674,035	18,050	37,525	55,575	.03	.0414
Thurston ...	931,093	210,580	154,370	364,950	.39	.0649
Wahkiakum	78,299	24 515	11,585	36,100	.46	.0461
Whatcom ..	1,221,764	40,670	60,920	101,590	.08	.0465
Totals	24,306,397	2,208,390	1,317,780	3 526,170	Average .145	Average .0422

The following table shows the present estimated total stand in the State of Washington. These figures were recently published in an article issued by the Forest Service:

Total Stand of Timber in State of Washington.

Species.	M ft. B.M.
Douglas fir	222.539,000
Western hemlock	52.672,000
Western red cedar	49,844,000
Amabilis fir	17 430,000
Western yellow pine	16,940,000
Sitka spruce	11,885,000
Western larch	1,933,000
Lodgepole pine	1.800,000
Engelmann spruce	1,300,000
Western white pine	1 181,000
Noble and shasta fir	514,000
White and grand fir	386.000
All other species	11,858,000
Grand total for State	390,282,000

The National Forest timber to the amount of 85,903,000 M feet b. m. is included in the above figure. A twenty-five per cent yield tax based on the actual gross stumpage receipts is now applied to the annual cut of timber from the National Forests.

In the report of the Forestry Committee of the Fifth National Conservation Congress on the subject of forest taxation is found a concise statement of the fundamentals of a forest-tax law applicable to the forest lands of the State of Washington. The law recommended for this region suggests a classification of forest lands on application to the State Forester and a tax on the yield of timber products. This article suggests a few further steps, such as the classification of all cut-over land as to whether its chief value is for agricultural or forest purposes. Classification of forest lands would mean a higher tax revenue, for a considerable portion of the land so classified would be agricultural in character, and this land would, of course, be subjected to a heavier tax than forest land. Taxing such land would also have a tendency toward its early occupation for agricultural purposes.

It is planned to district the State, first by the broad mountain barriers of the Cascades into the east and west side districts, and then into further divisions according to the relative importance of forestry and agriculture. Those counties having a large percentage of absolute forest lands would form one class, while those purely agricultural another. Application for cutting would have to be made to the county assessor and a statement filed as to the actual amount cut, with provisions for check-scaling outputs and penalties for disregard or falsification of records.

The taxing of forest land would be much the same as that advocated by the forest committee on taxation, only providing more specifically the rates of taxing reforestation land, immature timberland, mature timber-

land, and overmature timberland. A flat rate per acre could be levied against the various classes. All land which is not now classified as agricultural or forest land would be classed as agricultural land until application is made to have it examined for classification as forest land. This would insure a heavier land tax on land held for speculative purposes, and tend to induce settlement or development of those areas classed as more valuable for such purposes.

Assuming the annual yield to be six billion feet and the value to be twelve million dollars on a two-dollar stumpage basis, the application of a fifteen-per-cent yield tax would, in connection with a thirty-cent acreage tax on overmature timberlands, yield a revenue which would closely approximate present revenues. This tax would be applicable at a time when it could be most easily borne—when the crop is harvested.

In conclusion it can be stated that the bearing of the tax problem is so closely associated to the future welfare of the State that it does not seem possible that so vital an issue can lie dormant much longer without inciting the required legislative action.

SCIENTIFIC NOTES AND COMMENTS

A Cheap Fertilizer for White Pine Seedlings

On account of the high prices of commercial fertilizers resulting from the war, the results of an investigation into the most efficient and economical fertilizer for white-pine seedlings is of interest. The seedlings grew in the seed-beds two years, and were then transplanted. The same soil was worked over, the seed-beds were remade, and replanted to white-pine seed. All the seedlings on four square feet—they averaged just one hundred per square foot—of a normally stocked seed-bed were dug up carefully and submitted to the Agricultural Experiment Station at Amherst for analysis. The analysis resulted in the following figures:

	Tops.	Roots.
Green weight	261 gms.	85 gms.
Dry weight	170 "	79 "
Potash in dry matter	0.685%	0.722%
Phosphoric acid	0.482%	0.645%
Nitrogen	1.74%	1.255%

On the basis of four square feet bearing the above weight of seedlings, the fertility removed per acre is calculated to be as follows:

Potash	41.6 lbs.
Phosphoric acid	31.8 "
Nitrogen	94.6 "

The soil upon which these seedlings grew was fine sandy loam, rich in plant food, and accordingly it is safe to assume that the plant food extracted under such conditions would naturally be high.

The fertilizer expert at the same station recommended finely-ground garbage tankage, the analysis of which had been made, mixed with commercial wood ashes, in proportions of two tons of the garbage tankage to nine hundred pounds of wood ashes per acre. The garbage tankage tested 2.30 per cent nitrogen, .35 per cent potash, and 3.41 per cent phosphoric acid. The wood ashes supply the deficiency of potash in the garbage tankage. The actual results from the use of this combination remains to be seen, but there seems to be no reason why it should not meet requirements.

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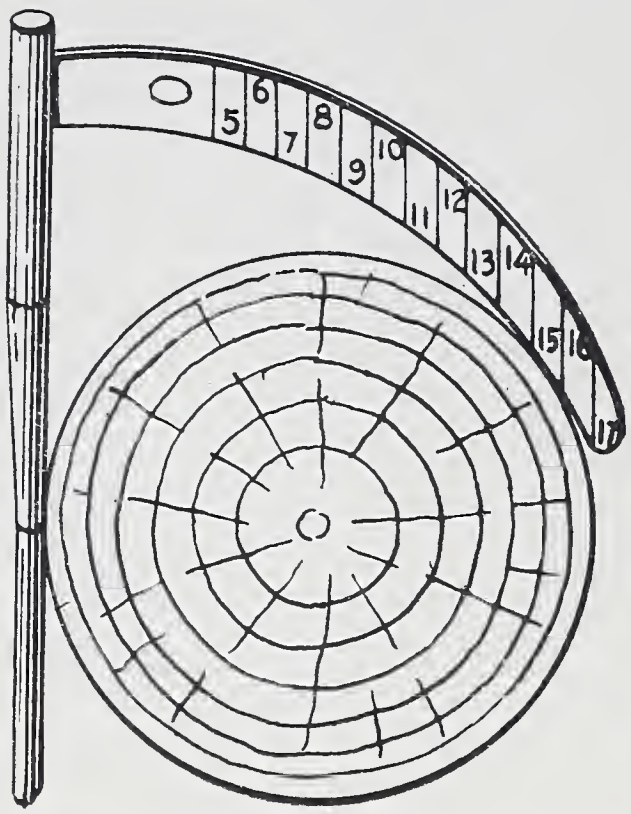
Another Caliper

An interesting caliper, known as the "Arvidsjaur" caliper, is described by Ferd. Lindberg in the Swedish forestry magazine "Skogen" for May, 1916. As shown in the accompanying cut, the caliper consists merely of two arms, one straight, the other curved. In actual use it is hooked about the tree at the desired point, and the diameter then read directly from the curved arm, on which the inch graduations are indicated. Although the caliper can be used for breast-height measurements, it is designed primarily for use on the end of a long pole for measuring diameters at considerable distances above the ground. It differs from the ordinary form of caliper used for this purpose chiefly in the curved arm, which fits the tree so closely as to reduce greatly the liability of error. Its chief advantages over other pole calipers are its accuracy, simplicity, and cheapness, the lack of cords and springs to get out of order, and the ease with which it can be used, even in dense forests. Its use is especially recommended in Norway spruce stands, where even very branchy trees can be measured with comparatively little difficulty.

In order to give the curved arm the necessary strength, it is often made of wood with a curved grain or of two pieces of wood fastened together with their grains running in opposite directions. When made of such species as oak and ash, however, ordinary straight-grained pieces are considered sufficiently strong without additional precautions. In measuring diameters at considerable distances above the ground, the caliper is attached to the end of a pole, and, in order to prevent splitting, is ordinarily fitted with a metal socket at the lower end.

The degree of curvature in the curved arm can be varied in different calipers according to the size of the trees to be measured, the smaller the trees the greater the amount of curvature allowable. It is, of course, an advantage for the curved arm to fit the tree as closely as possible, since the closer it fits the more accurately can the diameter be determined. The accompanying cut, for example, shows that in the case of a 17-inch tree the distance between the side of the tree and the inner edge of the caliper is only about 1.2 inches, while with a straight arm the distance would be about 6.7 inches. Half-inch graduations can, of course, be used if desired in place of the inch graduations shown in the illustration. In Sweden, the inner row of figures is often painted black, the outer row red, and the arm white, or the arm is painted black, with white figures. The pole to which the caliper is attached can also be used in connection with the Christen height measure by painting a white ring around it at the desired distance from its base.

In using the caliper both arms should be fitted close to the tree, and the line of sight from the eye to the curved arm, on which the diameter is read, should be parallel to the straight arm and the pole to which it is attached. If these precautions are observed, the author states that as accurate results should be obtained as with any pole caliper on the market. The author believes that it is destined to obtain rather widespread use in Sweden in connection with reconnaissance work, in which it is customary to take two diameters on all trees measured. In this country the main drawback to its use in this way would be that most of our trees are so tall as to make it impossible to take measurements up to any considerable proportion of their total height. It may, however, prove useful in the measurement of small trees, particularly second growth, and could perhaps be used for the determination of form, if form-factor or form-quotient tables could be prepared on the basis of height, diameter breast-high, and diameter at a fixed distance above breast height.



Application of Arvidsjaur caliper to the measurement of a 17-inch tree

One-tenth natural size

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NOTES ON FRENCH FORESTRY IN AFRICA AND CORSICA

Forest students can secure more information *of direct application to American conditions* in countries where forestry is not intensively organized. There is more of value *to the administrator* in North Africa and Corsica than in France proper, and more of value in France than in Germany. The reason must be clear. The theory of forestry is now established solidly enough to enable the elucidation of its general principles which hold under ordinary conditions. In a trip through France you see forest administration under the average conditions. What is difficult to understand are the exceptions to these general rules, whether made necessary by market, climate, species, or cost of administration. Such modifications from general forest usage are admirably illustrated in extensive French forestry. In France proper, intensive methods have

been systematized for more than a century, and radical changes are seldom necessary. In North Africa poor transportation and low prices force the omission of many silvical measures that may be possible in France, and necessitate many radical variations of absorbing interest.

The extensiveness of administration is in the order of conquest. Tunisia, a French protectorate only since 1881 (recognized by the English in 1888), is less intensively administered than Algeria, which was pacified as early as 1858. Corsica is, to be sure, a French department, ceded to France in 1759, but on account of the difficulty of lumbering the Corsican pine forests in the rugged mountains the management is perforce far less intensive than in the Jura, Vosges, or any part of France. A possible exception is found in the extensive cuttings in the southern Pyrenees near Oloron. Tunisia comprises 50,000 square miles, Algeria 184,474, and Corsica but 3,367. The administrative centers are: Tunisia, Tunis (near site of Carthage); Algeria, Algiers, with Oron and Constantine as secondary centers; Corsica, Ajaccio.

There is much to learn in Tunisia along the lines of extensive organization; permanent improvements; forestation; protection against sand, wind, and climate; fire protection, particularly as relating to fire lines, and modifications of the customary cutting systems made necessary by lack of transportation and low stumpage prices.

In Tunisia there are two types of administration—an intensive form for the valuable cork oak forests, and a cheaper, less intensive form for the Aleppo pine forests, valuable only for protection against erosion and wind or for a local fuel supply. The organization is not top-heavy; it is simple, and aims at the fundamentals of forestry rather than at the minutiæ covered so thoroughly on the continent. It naturally follows that the expenditures for fire protection are immeasurably more for the cork oak forests than for the less valuable Aleppo pine.

The protection of the Djerid oases is of particular interest to American foresters, since the theory and practice has a direct application in the United States. These oases are valuable irrigated farms that must be protected against drifting sand, over-grazing, and erosion. On account of the native population, the laws in regard to the use of fire within or near forests are especially strict; but the administration realizes that interior settlements are of protective value, since cultivated land forms admirable fire lines. Settlers living within forest boundaries are an asset when fire must be controlled. There can be no grazing in a forest for six years after a fire, and railroad rights of way must be cleared of inflammable debris and, if necessary, additional fire lines constructed parallel to the track. There can be no deforestation in reserved forests,

unless the wood is cut for use in protection against erosion, for the improvement of springs, or to stop drifting sand. The grazing control methods, although of wide interest, are comparatively undeveloped as compared with the United States.

Quite a feature of the cork oak management is the simplicity of regulation. It is very much as if the forester was managing a valuable crop of fruit trees which matured periodically. The approximate equal annual cut is secured by working about the same area each year, but the same cork oak forest is only worked for bark once in three years. A most important lesson to be gathered from a study of forestry in an arid country is the difficulty of restocking after the original forest has been destroyed. This principle must apply with equal force in our Southwest. This is to be expected, since the period of drought occurs during the summer months, when the plants are less able to withstand lack of moisture than during the cooler weather. The methods of forestation, moreover, have an exact application in southern California, where the winter rains correspond so closely to those in Tunisia. On the more favorable situations the seed-spot method of sowing is preferred; on the more difficult sites, ball-planting must be resorted to, notwithstanding the additional initial expense. In order to reduce the cost of forestation, spacing as wide as six by eight feet is officially allowed, but in practice they are rarely more than 250 seed-spots per acre. *Sowing or planting just before or during the winter rains is the invariable practice.* Thus far the scale of operations has been so small that forestation in Tunisia may still be considered as experimental in character.

The accomplishment in Tunisia since 1885 has been considerable, considering the small appropriations which were available. The administration is essentially simple, economical, and practical; the budget is based upon the revenue rather than upon an ideal.

Much the same climatic and topographic conditions found in Tunisia are characteristic of Algeria. Perhaps the most remarkable features of the forest administration are: The unfortunate sales of federal forests by Napoleon; the difficulty of preventing trespass and theft; fire protection (although it cannot be said to be uniformly successful); forestation, and the Algerian code.

Unquestionably the progress made in Algerian forestry from 1900 on is due to the forest commission, that made a careful study of conditions and suggested very radical improvements both in methods of administration and in laws. The results of this study are found in the Algerian code of 1903 (see "Forestry Quarterly," vol. XIV, No. 1, pp. 66-80). It is very significant that this commission felt the preservation of existing

forests and brush cover of vital importance to the health, prosperity, and habitability of Algeria. If the conclusions of this commission are correct, then the policy of the Forest Service, U. S. Department of Agriculture, can be questioned if it eliminated from the National Forests in Arizona and New Mexico, and other parts of the West, vast areas of woodland type.

The mistakes made by the early forest administrators are undoubtedly characteristic of all initial efforts: The inclusion of needless agricultural land within forest boundaries; failure to properly consider and educate local sentiment favorable to conservative forest control; a literal rather than a practical enforcement of laws, which in many cases were often ill-adapted to administrative enforcement. Administrative organization must always depend on practicability rather than on theory. This is well illustrated in Algeria by the departure from the standard organization common in France. In France the conservator is in charge of a conservation which is split up into forests under inspectors or assistant inspectors. In Algeria this organization would have been too expensive and it would not have provided suitable positions for men of relatively low rank who were sufficiently advanced, however, to care for the simple administrative needs found in extensive forest management. Accordingly, the present conservator directly supervises "chefferies," or small forest subdivisions, which correspond closely to one of the detached units administered by American forest supervisors. A specific example is the Coronado Forest in southern Arizona, where one supervisor is now administering what was formerly the Baboquivari, Dragoon, Huachuca, Santa Catalina, Santa Rita, and Tumacacori Forests. According to the Algerian form of organization, these different forest divisions would be split up and administered locally by a forest assistant, head ranger, or deputy supervisor, *acting under the District Forester*, instead of being administered from Tucson as one unit. Another interesting variation in the usual form of organization is the appointment of controllers or general inspectors in each of the three conservations (at Oran, Constantine, Algiers). Such an officer inspects officials of less than his own rank. Since the military form of organization is current, it means that the general inspectors who, in the regular organization, have the title and rank of "inspecteur," cannot inspect a "chefferie," if it is in charge of an "inspecteur," except in cases of emergency. It is interesting to see that the difficult lot of the Algerian forest officer is in part compensated by increased pay and liberal travel and educational allowances; he is granted a maximum of 30 days' leave per year, cumulative up to 2 years, and transportation for himself and family between France and Algeria.

The subordinate force, stationed as they frequently are in out-of-the-way places, must send their children to school in the near-by towns, and the Forest Service pays something to defray this increased cost of boarding-school education.

The administration is unquestionably progressive. The development of a new industry, such as the turpentine operations in the Aleppo pine forests around Oran, is worthy of American progress and ingenuity. The silvical treatment of these forests seems practicable and at the same time sufficiently conservative to insure regeneration. After a study of management in Europe proper, one would anticipate rather complicated, impracticable regulation in Algeria, but such is far from the case. What could be simpler or more feasible than the so-called "bundles of management" which digest the local management methods? In estimating the yield of cork oak, the assessor inexpensively determines with sufficient accuracy what the annual production will amount to. It is parallel to the American forester in New England, who takes as his criterion in coppice a yield of a cord per acre per year, and then deducts according to the quality of the soil, when estimating the annual growth. Another difference between the methods in France and Algeria is in the sale of cork. In France practically all timber is sold on the stump, after it has been marked, and the lumbering is entirely at the risk and cost of the purchaser, subject to stringent cutting regulations. In French cork oak forests the lumbering is done by the government, and the cork is not placed on sale until it has been collected at local depots.

There is much the same forestation policy that is found in Tunisia. They believe that the prevention of the destruction of forests is far better than the cure—reforestation. Winter sowing or planting after the rains have commenced is almost universal. The sowing is usually in carefully prepared seed spots in preference to planting, unless the conditions are so unfavorable that the success of sowing would be problematical. They favor local nurseries rather than central nurseries, which require the expensive and deletirious shipment of planting stock. When difficult planting must be attempted, frequently ball plants are used, notwithstanding the increased initial cost. Contrary to expectation, planting in brush-covered areas was very unsuccessful, if part of the brush was left as a protection against the sun and wind. Success was only secured after practically brushing out the whole area to be planted since: otherwise intense radiation, extreme heat, lack of air currents, and increased damage from rodents prevented the growth of more than a small percentage of the stock. The systematic routine methods in forestation are worthy of study by all American State and Federal forest officers, who must

cope with arid and difficult sites. Notable plantations have been established at Constantine, Bainen, Orleansville, and Oran. Local species gave the best success sown in seed-spots or grown in essentially local nurseries. The cost of these plantations has been in the neighborhood of $8 to $12 per acre, and success was only attained after repeatedly stocking areas which had shown initial failure.

Even with stringent fire laws, conscription of fire-fighters, forced cooperation of the civil authorities, and with the concentration of improvement work during the most dangerous part of the fire season (so as to furnish fire-fighters in out-of-the-way parts) protection has not been altogether successful. Recently boundary, secondary, and main fire-lines have been constructed at considerable expense. Notwithstanding the clearance of these lines every three years, fires continue. In the technique of fire-line construction progress has been made, but it appears that instead of clearing lines every three years it would be preferable to clear one-third of all lines (except those less than 15 meters in width) every third year, so that a portion of the line would always be clear of grass and debris. For permanent fire lines they have unquestionably determined that it is cheaper in the long run to grub brush and trees out by the roots, rather than to have the increased annual expense of cutting down shoots and root suckers. The conclusion may be formed, however, that fairly narrow lines along ridges or dry arroyos are of unquestionable value, both as a means of communication and as a point to fight fire from—notwithstanding the disastrous results from indiscriminate back-firing. As in Tunisia, the administration is simple, economical, efficient, and is a credit to France.

Forest administration in Corsica is hampered by an unruly population, by overgrazing, by fires, and in past years especially by lack of communication. As in France, there are federal, communal, and private forests, and the organization is the same as is found on the continent. If it were not, however, for the inaccessibility of the Corsican pine, growing at a higher elevation than the maritime pine, but below the beech and fir, there would be but little forest wealth left on the island, since it has been settled for the past 2,000 years. The great lesson to be learned from a study of Corsican forestry is in the method of cutting Corsican pine. To start with, an application of the shelterwood system resulted in large areas of young even-aged coniferous stands. To be sure, it is theoretically poor technique to reproduce even-aged stands of young pine over large areas where fires are frequent; but technique here was secondary to the practical requirement of large sales. Long-term sales for large amounts were a necessary evil in order to justify contractors in building

expensive wagon roads. Much the same solution has been found true in the western United States. To start with, the Forest Service limited its sales to less than 30 to 40 million feet. Today, in order to justify improvements such as railroads or flumes, sales from half a billion to a billion board feet have been recommended. Bearing in mind, therefore, the practical sales conditions and the danger from fire, the fairly intensive group selection system, with thinnings, seems to be an admirable answer to the problem of regeneration. There is no rigidity in the application of the selection system. There are seed fellings, secondary fellings, final clearances, cleanings, and thinnings, as with the shelterwood system; but each operation covers but an acre or two, so that the result is an uneven-aged forest by groups.

The methods of determining the rotation and estimating the yield are similar to those in France. In Corsica the methods are, however, less intensive. The dangers of over-cutting, owing to slack regulation in past years, are admirably illustrated by many of the Corsican forests, where today one finds the growing stock depleted and exhausted. In many respects the sales conditions contained in the sale contracts are similar to those used by the Forest Service, U. S. Department of Agriculture, but there is one vital difference. In Corsica the concession of making sales for large amounts and for terms of years was justified by the resulting improvement in communications. There such large sales are considered an unquestioned evil, but necessary until the transport of small-sale products is made feasible, through the construction of logging roads. In the United States steam transportation precludes the development of a wagon-road system by purchasers.

Where the administration seems to have failed is in the proper education of the native population in the value of conservation. It seems almost incredible that out of almost 600 trespass cases (brought in 1911 before the courts) more than half were acquitted. There is marked contrast between this lack of success in preventing, controlling, and punishing trespassers in Corsica with that made by the Forest Service in the western United States, where today trespass is practically a thing of the past.

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A Course in Methods of Field Experimentation

The University of Chicago is offering during the summer quarter a course dealing with the methods used in ecological work, particularly with respect to the measurement of environmental factors and field experimentation. Dr. George D. Fuller, who is in charge of this course, writes about it as follows:

"It is a new venture on my part, but during the past two years many of my students have expressed a wish to become acquainted with atmometers and similar instruments. At present I have no duplicate outline of the work of the course, but I intend to take up such things as soil moisture determinations, including the determination of moisture equivalent, willing coefficient, and hygroscopic coefficient; evaporation atmometers, their standardization and use; rainfall determination, transpiration studies by cobalt paper, and other methods and light measurements.

"The literature on these topics will be discussed and practice given in the use of the instruments. If time permits, some little attention may also be given to statistical methods in studying vegetation. My aim is to discuss only such methods as have proved, or seem fairly certain to prove, of genuine use in terms of plant growth. It is my intention to repeat the course somewhat elaborated in the spring quarter of 1917. The present course will extend from July 27 to September 1."

Since there is a most intimate connection between the problems of forestry and of ecology, the methods of study are very much the same in the two branches of science. This course, therefore, must be of as much interest to foresters as it is to prospective ecologists.

REVIEWS

The Forest Service Reports on Wood-Using Industries of the States

Since about 1910 the U. S. Forest Service has been preparing reports on the wood-using industries of the several States, usually in co-operation with some State department. Although they are all written by members or ex-members of the Forest Service, except for an occasional chapter by a local man, only one of them is a government publication. Notices or abstracts of several of them have appeared in the Forestry Quarterly from time to time, but without any comment, except in the case of the one on Arkansas. A general account of the whole series, as far as published, may therefore be of some interest.

Of 32 of these reports that have been seen by the reviewer, Hu Maxwell is sole or joint author of 14, R. E. Simmons (alone) of 6, J. T. Harris of 6, J. C. Nellis of 3, C. W. Gould, C. F. Hatch, and A. H. Pierson of 2 each, and several other men of one each. The one on Arkansas is a Forest Service bulletin (No. 106); six or eight are bulletins of State agricultural departments, experiment stations, or geological surveys; about the same number were published by State forestry departments, but mostly without numbers, while several are State publications without any series or department indicated, so that one would hardly know where to apply for a copy. All these are approximately octavo in size, and average 100 pages each. Several others were published in lumber journals, with pages about a foot square. Some of the unclassified State publications are not dated, but are probably among the oldest of the series.

These reports are intended to cover all industries which make out of wood something more elaborate than rough lumber. They do not consider, except incidentally, timber-camp products, such as cross-ties, posts, poles, cordwood, and tanbark, or ordinary sawmill products, such as lumber, laths, and shingles; neither is much space devoted to veneers, cooperage stock, pulpwood, maple sugar, or naval stores, for statistics of all or nearly all of these primary forest products are gathered and published annually (and more thoroughly decennially) by the Forest Service and Census Bureau together. It is of course impossible to draw a sharp line between crude and manufactured forest products, however. Most of the industries covered by this series of reports start with lumber that has been

through a sawmill, but some take logs or bolts direct from the timber-camps.

The general plan of the simplest of these reports, in whatever form they are published, is about as follows:

Table of contents.
Introduction.
Table of kinds of wood used, with quantities, prices, and amount grown within and without the State.
The kinds of wood in detail, by species, with notes on distribution and uses, and amounts used by different industries, with prices.
The industries in detail, with kinds of wood used, prices, and percentage of each species obtained from within and without the State.
Species of wood, arranged alphabetically by common names, with list of articles made from each.
Directory of manufacturers, classified by industries.

The above represents about the minimum, but the sequence is not always the same. Many of the reports have extra features of considerable interest, which will be reviewed briefly.

About one-third of the number are illustrated by half-tones of forest or wood-working scenes, those for Minnesota, New Hampshire, and South Carolina being among the best. Some contain sketches of the geography and forest conditions of the State, notes on the history of forest exploitation (those for Michigan and Mississippi being noteworthy in this respect), recommendations for the future, and statistics of some of the primary lumbering industries, taken from the census publications above mentioned.

The notes on red cedar, Spanish moss, Circassian walnut, and veneers in the Alabama report are quite instructive. The one on Arkansas contains an account of the two national forests in the State, which justified its publication as a government bulletin.

The report for Florida contains a list (arranged alphabetically by supposed common names) of the rarer and little-used trees of the State, with notes on the distribution and possible uses of most of them. The one for Louisiana contains some interesting notes on the use of wooden cisterns in New Orleans, and a chapter on the Spanish moss industry, which is most highly developed in that State.

In the Maryland report, the State forester gives an estimate of the forest area, standing pine and hardwood over 10 inches in diameter, and stumpage values for each county and the whole State, which is the only table of its kind known to the reviewer. According to this estimate, the ratio of hardwood to pine is a little more than 2 to 1. (Hemlock is

counted with pine in the westernmost county, but nothing is said about spruce, cedar, cypress, etc.)

The Mississippi report, published in 1912, contains, among other interesting features, some notes on the duration of different kinds of evergreen leaves, and a little correlation of them with soil and climate, foreshadowing a hypothesis expounded by the undersigned a year or two later. In the Missouri report there is a list of exceptionally large trees of several species that have been found in alluvial bottoms in the southeastern part of the State.

The notes on cedar and yellow poplar in Tennessee are of more than passing interest. The Texas report, something like that for Florida, contains a long list of small or rare trees that are little used, with notes on their distribution and possible value. The observations on Osage orange and several other species are well worth reading.

In the one for West Virginia, the 68 most important trees of the State are listed, in botanical order, with common and technical names. On page 47 it is observed that loblolly pine does not grow in West Virginia. which is contrary to reports in some of the published floras of that State, but probably correct, for in that latitude that pine is almost confined to the coastal plain and to low altitudes, and its occurrence in a mountainous country like West Virginia would be very strange.

With all their excellent features, these wood-using reports are not wholly free from errors and other defects, some of which are easy to excuse, while others might have been avoided by taking a little more pains.

Some of the "spruce pine" reported from Alabama may possibly be *Tsuga Canadensis*, which is called by that name toward its southern limits, and is not otherwise mentioned in the report. (The settlement of Spruce Pine, Ala., takes its name from that tree. See Bull. Torrey Bot. Club 33: 524-525, 1906.) And if any *Pinus Virginiana* was used it may have been included under the same name. The "pin oak" is probably not *Quercus palustris*, for that is not known in Alabama, and the "wild china" may be the commonly cultivated or escaped chinaberry, *Melia Azedarach*, rather than *Sapindus*. (For some unaccountable reason, the name "chinaberry," which is used by millions of people in the South, is rarely seen in botanical literatutre.)

Under long-leaf pine it is said that "the original stands of this species . . . shade the ground so effectively that they suppress the seedlings of most other trees, and thus they have held their place for long periods of time in nearly pure forests." (But long-leaf pine is one of the least tolerant trees there is,[1] and it is probably not shade that keeps

[1] See Zon & Graves, Forest Service Bull. 92, p. 22, 1911.

out other trees, so much as fire.) The statement that white pine "does not grow in commercial quantities in Alabama" is true as far as it goes, but does not go far enough, for that species is not known within fifty miles of Alabama. The opinion that the "evergreen magnolia" is more abundant than the "sweet magnolia" (better known throughout the South as "bay") is not well founded. (See statistics for these two species on page 213 of this volume.) We have as yet no evidence of the occurrence of *Nyssa Ogeche* (mentioned under gums, p. 21) in Alabama.

In the list of industries there is no mention of wooden paving blocks, which were being manufactured in Mobile (within a stone's throw of one of the establishments listed) at the time the report was published, and probably for some years before and after; and nearly all the wood-working plants in Etowah county seem to have been overlooked.

The one on Arkansas (pp. 7, 8, 23) reports several million feet of long-leaf pine as cut in that State in a year, although botanists have never found any evidence of its growing there at all. On page 24 is the remark that "there is little or no Cuban pine in Arkansas, but it may spread into the State from the south"—a wholly unwarranted statement, in view of the fact that the species which has been going by that name among American foresters is not known west of the Pearl River, in Mississippi, and has not extended its range appreciably since it was first distinguished by botanists (which was about 1880). On the same page we read that "fire is harmful to any kind of trees, and if often repeated will finally destroy all woody growth and change a region to grass or weeds or to bare rock or sands." This is somewhat overdrawn, for before the stage of absolute barrenness arrived there would be a time when the vegetation would be too sparse to carry a fire, as in the sage-brush and greasewood deserts of the West today.

The Florida report is marred by numerous typographical errors (listed in a whole page of errata in the first edition, but most of them repeated in the second) and errors of compilation, the latter mostly in the list of small and rare trees. Erroneous notions about the effects of fire crop out in several places—for example, in the statement that "the habit of frequently burning forest lands perhaps works more harm to long-leaf pine than to any other tree." (The fact that long-leaf pine is more nearly immune to fire than almost any other tree was recognized by a few nineteenth century writers, and emphasized by Pinchot in the National Geographic Magazine for October, 1899, p. 398.)

In the Georgia report the notes on distribution and dimensions of some of the trees (*e. g.*, loblolly pine, pond pine, cypress, chestnut, and sweet magnolia) seem to have been copied in part from a continued

article by the reviewer on Georgia's forest resources in the first volume of Southern Woodlands (Athens, Ga., 1907-8), but the geographical sketch which formed the first instalment of that series must have been overlooked, judging from the unsatisfactory treatment of the geography of the State in the wood-using report.

In Louisiana 50,000 feet of "Cuban pine," all grown within the State, are said to have been used by wood manufacturers in one year. Botanists have not yet found any such tree in Louisiana, however. (See remarks under Arkansas on preceding page.) The predictions of the future of the forests and the discussion of the effects of fire on long-leaf pine are rather pessimistic.

The Maine report, though containing much valuable information, is marred by some lapses. On the first page the area originally forested is given as only 2,420,000 acres, or 12 per cent of the State. On page 91 the wording is such as to class paper birch with the conifers. The table of contents is placed at the end, and miscalled "Index."

It seems rather strange that 75 per cent of the loblolly pine, 86 per cent of the white oak, and all the cypress and hemlock used by Maryland manufacturers should have come from other states, for those species are fairly common in Maryland, the pine perhaps more so than any other tree in the State. (See Forest Products of the U. S., 1909.) Shortleaf pine is not mentioned at all, but very likely it is rarer in that State than one would suppose from current maps of its distribution.

Ten per cent of the nearly 15 million feet of yellow poplar used in Massachusetts in a year is said to have grown in the State; but that is a rare tree in Massachusetts, and the census does not report any of it as having been cut in that or any other New England state in 1909.

In the Michigan report (page 9) some of the former white-pine area is said to be on the way to becoming a desert of wind-blown sand. But probably there is little need for apprehension on that score, for in the summer of 1912 the reviewer spent several weeks in the sandiest part of the Lower Peninsula, where the white pine had been cut 25 or 30 years before and was not reproducing itself appreciably, and did not see or hear of any drifting sand except a little on the shores of lakes.

On page 17 of the Minnesota report it is stated that a little more than a third of the 10 million feet of hemlock used in 1911 grew in the State, but that is not consistent with the table on page 26, and hemlock must be rare in Minnesota, for it was not definitely known in the State at all until 1890. (See Garden and Forest, 3 : 496, 553-554; 6 : 418; also Sargent's Silva, 12 : 64, 1898. The census reports over 15 million feet of hemlock sawn in Minnesota in 1909, but perhaps most of that was imported from Wisconsin, like the white pine sawn in Iowa.)

In the one for Mississippi (as also for Alabama) there are some unfounded and unnecessary speculations about the probable migrations of "Cuban pine." *Pinus clausa* is said to occur in the State, though no botanist has yet found it west of Mobile Bay. Over 6 million feet of "pond pine" grown in Mississippi is listed in the table of planing-mill products on page 23, but if *Pinus serotina* is meant, that species is not known within 100 miles of there. On pages 23 and 24, 50,000 feet of Mississippi-grown *Quercus palustris* is listed, but if any definite locality for that species had been designated it would have been interesting news to botanists.

In the Missouri article it is stated that six species of cypress grow in the United States, four in the West and two in the South and East This lumping together of the very distinct genera *Cupressus* and *Taxodium* reminds one of the tactics of the Louisiana cypress manufacturers, who in advertising their product (*Taxodium*) in newspapers and magazines in recent years sometimes mislead the public by stressing the reputation of the Old World cypress (*Cupressus sempervirens*).

In Tennessee it does not seem quite plausible that all the cypress used should have come from other states (for it is fairly common in West Tennessee, and over 8 million feet were cut there in 1909) or that 25,000 feet of home-grown *Thuya occidentalis* could have been obtained in one year.

In the list of rarer trees of Texas, arranging them alphabetically by common names is of no advantage, for many of the alleged common names are mere book names, and would never be looked for by a non-botanical reader. (The same can be said of the similar list for Florida.) A botanical sequence would have been just as convenient for the reader, and would have brought related species together. The list contains a few species that are not known in Texas, some that occur only in cultivation, and some that are nothing but shrubs (*e. g.*, mistletoe and prickly pear).

As foreshadowed above, one of the most serious defects of this series of reports, especially those dealing with the southeastern States, arises from the wrong identification of some of the trees. Certain vernacular names which have become pretty widely disseminated in the literature of botany and forestry are rarely or never used by lumbermen and other people who are not acquainted with such literature, and when a lumberman is asked for statistics about a certain kind of wood under a different name from that he is familiar with confusion naturally results. One of the worst cases is that of loblolly and short-leaf pine, already commented on by Mr. Ashe in the April number of this magazine. In the

Arkansas wood-using report it is observed that not one manufacturer reported loblolly pine; but the reason is obvious: no such name is used in Arkansas (or anywhere else much). In Alabama less than 1 per cent of the wood used is classed as loblolly pine, though the species to which that name is usually applied makes up 14 per cent of the forests, according to the writer's estimate in the April number, and is certainly cut in large quantities. In almost every case where the figures for "short-leaf pine" are greater than those for loblolly one can be reasonably certain that much of the *Pinus Tæda* has been returned as short-leaf. for that is its usual name. It is probably useless to expect lumbermen to distinguish between *P. echinata* and *P. Tæda.*

A somewhat similar case, not mentioned by Mr. Ashe, is that of "Cuban pine." No such name is in *bona fide* use anywhere in the lumber world, but if used at all it should be restricted to *Pinus Cubensis,* which is said by good authorities to grow only in eastern Cuba. Two southeastern pines, *P. Elliottii* and *P. Caribæa,* were formerly confused with it. The former is not known south of De Soto County, Florida, but the latter is abundant in South Florida, and is said to grow also in western Cuba (nowhere near *P. Cubensis*), the Isle of Pines, and Central America. The former was confused with long-leaf pine by botanists up to 1880, and is by many people even yet, but is distinguished as "slash pine" in Georgia (presumably on account of its frequent occurrence in small branch swamps or "slashes"). *P. Caribæa* is also known as slash pine in some parts of Florida, but in the extreme south, where it is the only representative of the genus, it is simply "pine." In Mississippi the name "pitch pine" (and perhaps also loblolly) seems to be applied to one or both of these species. (The differences between them are not very plain, and need not be discussed here. For notes on the pines of Cuba see G. R. Shaw, in Gardeners' Chronicle, March 19 and August 6, 1904, and his recent monograph of *Pinus.*)

The names of some of the oaks and several other trees have also given trouble to the compilers of these reports, but it would be tiresome to go into all the details. Some such errors are probably inevitable, but many of them could have been avoided by securing botanical specimens or carefully examining wood specimens of the trees in question, or even by consulting some person familiar with the distribution of the species, or a few reliable local floras, while the reports were being written. A little more pains should have been taken to ascertain the local common names, instead of confronting the lumbermen with wholly unfamiliar book names.

The fact that a few of the reports are falsely dated (not having come out until the year following the alleged date), or not dated at all, and others not numbered, is a little annoying to one who has regard for bibliographic niceties, and the variations in size of page interfere with standing the series in a row on a shelf. It is to be hoped that these valuable reports will be revised and brought up to date every ten years or oftener, and made more uniform in size and treatment, with some of the speculations and predictions omitted and the easily avoidable errors corrected.

ROLAND M. HARPER.

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SIGNIFICANCE OF MYCORRHIZÆ IN THE LIFE OF TREES[1]

In a highly interesting and very able manner the author has traced the history of the investigations and the development of the theories relative to this group of fungi which enter into our present conception of them. The mycorrhizæ form a group of fungi which have been the subject of much study and investigation by many of the most distinguished scientists along this line. The most common and general idea of fungi, or fungus, perhaps, is that of a parasite preying on a higher host plant, retarding its growth and development, and even causing its death. This is largely due to the fact that the parasitic fungi, with one or two exceptions, are the most conspicuous on account of their destructiveness. Fungi are, however, not all parasitic. They constitute one of the lowest divisions of the plant kingdom, and are made up of plants lacking in chlorophyl, largely incapable of forming their own plant food from the elements, and therefore dependent upon organized matter, either living or dead. One class of the fungi are confined to dead organic matter, while another class requires living plant or animal tissues for their development; still others spend a part of their life cycle on dead matter, and complete it on the living, while some groups are not confined to either medium, but use one or the other as chance happens.

The author opens the discussion by pointing out the importance that had been attributed to this group by many botanists from the fact that they are supposed to play an important part in the nutritive processes of the vascular plants, acting as an intermediary in their nourishment from the soil—that is, the absorption of plant food takes place through the

[1] "The Present State of Our Knowledge of the Physiological Significance of the Mycorrhizæ of Trees," by Prof. D. L. Petri, published in the Monthly Bulletin of the International Institute of Agriculture, Volume VI, Number 9, September, 1915.

means of the mycelial sheath around the roots. Just what part they play is still unsettled. It still is a question whether mycorrhizæ should be regarded as (1) indispensable, (2) merely useful, (3) injurious, or (4) as simply harmless excrescences in their relation to the host plant.

After a short preliminary discussion the author then takes up the historical summary and gives the views of the leading investigators who have studied this group from the time of Theodor Hartig, in the middle of the last century, to the present. The most consistent theory regarding the function of this group borne out by a number of experiments and observations by able investigators point to the relation between the host and the fungus known as symbiosis, in which both host and parasite are mutually benefited. This theory was first brought forward by Frank in 1885, and although it has been contradicted in part and modified by later investigations, it seems still to offer a probable explanation of the group. This theory was based on the following observations: (1) the constant presence of mycorrhizæ on forest plants; (2) the abundance of these formations in humous soils of which the nitrogenous substances cannot apparently be utilized by the roots; (3) the insufficiency or absence of root-hairs in plants with ectotrophic (outside) mycorrhizæ; (4) the absence of nitrates in the roots of these plants. For a period this fascinating theory held sway, and then the group, having been the subject of much investigation, contradictions appeared, and the views swung entirely in the opposite direction, and it was held for a time that there was no mutual relation and that, if the fungus had any effect at all, it injured the host. In covering this part of the subject, the author makes one remark which is instructive in regard to how even the best investigators are apt to spring from one view to an entirely opposite one. He asks: "Should we be justified in considering as useless to Leguminosæ the symbiosis of their roots and nitrogen-fixing bacteria, merely from the fact that it only exists to a very small extent in soil rich in nitrates?" indicating that the most reasonable view is that there is possibly a symbiotic relation under certain conditions, while under other conditions this relation may not exist, and perhaps the mycorrhizæ may even act as an injurious parasite.

In concluding the paper, the author states that the primary fundamental idea to which it is possible to attain is that all trees are facultative mycotrophic plants (*i. e.*, may or may not have root fungi); symbiosis between their roots and mycelia is not, therefore, a biological necessity for them. It has further been proved that the fungi capable of causing the formation of ectotrophic (outside) mycorrhizæ on the same plant may be of different species; this shows that the tree does

not select its root symbionts, but that the association is entirely fortuitous. As for the advantages which could accrue to the plant from the symbiosis, no one has ascertained whether they exist and in what they consist.

He finally concludes by saying that however justifiable the theory of mutuality may appear, the results of thirty years of scientific research, at least so far as arborescent plants are concerned, have led neither to its confirmation nor yet to its definite rejection.

This paper should prove very interesting to all foresters, and can with profit be read by them. There are surprisingly few technical terms to interfere with gathering the meaning off-hand of the subject, and while it may seem a small part of a subject belonging strictly to specialists, it is important from this fact that this group of fungi have to do with a more or less profound change in an organ of the highest importance to the nutrition of trees. The interesting manner in which it is written, and the fact that it brings all the information on an important subject dealing with forest trees to date, should cause it to receive attention from foresters.

E. R. Hodson.

Forest Service,
June 26, 1916.

Forest Legislation in America Prior to March 4, 1789[1]

This intensely interesting publication, as stated by the author in a footnote, is a part of a study presented to the faculty of the Graduate School of Cornell University in partial fulfillment of the requirements for the degree of master in forestry. It is believed that to the average American it is little short of a revelation.

The author brings out, what perhaps to many American foresters is an original fact, that forest preservation and extension in America did not have their real beginnings in the nineteenth century, but "that forestry and timber problems had claimed the attention of colonial legislative bodies on many occasions during the seventeenth century, and that hundreds of such laws had been enacted previous to the establishment of the national government."

Many years previous to the adoption of the Federal Constitution on March 4, 1789, many of the colonies, as was natural, had been brought to realize the ill effects of forest fires, attempting, as they were, to wrest

[1] Kinney, J. P. "Forest Legislation in America Prior to March 4, 1789." Bulletin 370. Cornell University, Agricultural Experiment Station of the New York State College of Agriculture, Ithaca, N. Y., January, 1916.

a livelihood from what then was in reality an impenetrable forest. Even as far back as March 29, 1626, Plymouth Colony began to cry the wolf of timber famine, which to us of this day seems almost amusing. The Plymouth ordinance of 1626 recited the inconveniences that were likely to arise in any community from the lack of timber, and declared that no man should sell or ship any timber whatever out of the colony except with the Governor's or Council's approval. Was this the original seed of conservation, or was it due to a realization that here were illimitable quantities of fine timber at their very doors, and with the proverbial New England thrift and foresight they desired this resource to remain forever within their little colony?

As early as 1633, in the Plymouth Colony, the setting of fires in the woods was forbidden during the fall and winter months, and the firing of woods during the remainder of the year was allowed only upon warning to one's neighbors. The stern and grim penalty for breaking this law was a fine of 10 shillings or a whipping! The restriction regarding the setting of fires in Massachusetts Bay Colony antedated the Plymouth law, being passed in July, 1631. Here also a whipping was the wholesome penalty, to be administered to either man or woman breaking the law. Other New England colonies very early passing some form of forest or fire legislation were New Hampshire, Connecticut, and Rhode Island, most of the laws providing for an open season for setting fires. Rhode Island prohibited the setting of fires in the woods except from March 10 to May 10, and on Saturdays and Sundays within this period.

New York, under the Duke's Laws, published in 1665, likewise forbade setting fires out in the woods or commons or on one's own lands, and the person so doing should be liable for one and a half times the damage, and in default should receive stripes. New Jersey and Pennsylvania passed forest fire laws in 1683, and Delaware, as a separate colony, in 1739; North Carolina, in the acts of 1777, went on record against fires, stating that forest fires were "destructive to cattle and hogs, extremely prejudicial to soil, and oftentimes of fatal consequences to planters and farmers by destroying their fences and other improvements." Here we get a new point of view—that forest fires were injurious to the soil, and therefore to planters and farmers—but nothing was said of the destruction of the timber. The North Carolina laws went more into the details of the penalties, stating that any vagrant, slave, free negro, or mulatto unable to pay the fine, should "receive on his bare back 39 lashes, well laid on." Would that such a Federal law existed today! Our fire organizations and plans would be useless.

Not only did the early colonies realize the disadvantages of fires in

the forests, but provided restrictions on shipping lumber, the felling and not using of timber, restrictions in the cutting of timber for one's personal use, prevention of timber trespass, cutting of timber on another's land, etc.

Typical of the name which he gave to the State, William Penn published a document in England which, among other wise things, declared that care must be taken to leave one acre of trees for every five acres cleared; whether the selection, clear-cutting or strip-system was to be followed record sayeth not.

Maryland, in 1692, granted certain free use of timber to any one who would build a mill. The General Assembly of Virginia, in a letter dated March 28, 1628, to the King, advised him that pipestaves, barrel boards, and clapboards, as well as pitch and tar, could be procured in great abundance, but that the freight was too high! Not until 1752 did Virginia recognize the need for timber inspection, although Massachusetts Colony had provided for timber inspection in 1646. In 1787 lumber inspection was provided for for barrel staves for export from Virginia to Madeira and the West Indies, the Virginians probably being brought to realize the importance of having good, solid barrel-stave material from having suffered a loss of many gallons of good old Madeira in its long journey across the Spanish Main.

The bulletin tells us that the standard cord measure, as used today, was fixed by the Massachusetts Bay Colony in 1647, being adopted later by practically all the other colonies.

The British Crown early manifested an interest in the timber and timber-product resources of the colonies. Connecticut in 1644 granted two men the privilege of making tar under certain restrictions in the colony, although later some of the inhabitants made a complaint on account of the disagreeable smell of the tar near their homes. Thus in 1644 began the American naval stores industry. In 1671, Massachusetts Bay Colony granted a company a ten-year monopoly "to make for sale pitch, rozin, turpentine, oyle of turpentine of the pine or cedar trees."

"With a view to establishing a permanent source of naval stores within its own dominions, the British Parliament in 1704 passed an act which placed bounties on tar, pitch, rosin, turpentine, hemp, masts, yards, and bowsprits imported from the American colonies into Great Britain. For the preservation of trees fit for the production of naval stores, this act imposed a fine of five pounds for the offense of cutting or destroying a pitch pine tree or a tar tree, under 12 inches in diameter 3 feet from the ground, not within a fence or an actual inclosure, within the colo-

nies of New Hampshire, Massachusetts Bay, Rhode Island, Connecticut, New York, and New Jersey, and fixed a fine of ten pounds for the offense of wittingly or willingly firing any woods or forest in which there were trees prepared for the making of pitch or tar, without first giving notice to the person who had prepared the trees for the making of pitch or tar, in any of the said colonies."

Nor were the interests of the colonies confined to forest fires, timber inspection, and barrel staves, for as early as 1739 the Massachusetts General Court declared that great harm had been done to the beech grass on the shores of Cape Cod by cattle and horses, and that as a result the sands were drifting inland, causing great destruction, and thereupon prescribed a fine of 40 shillings per head for each neat cattle, horse, or mare that was turned loose upon the meadows and beaches of Truro. Thus we get the first record of an attempt in America to regulate grazing. And a stiff trespass fee was wisely imposed!

This publication contains an excellent table of contents, a complete bibliography, and has within it so much of interest that it is difficult to refrain from quotation. Altogether, it is an intensely interesting and valuable contribution to the history of American forestry.

JNO. D. GUTHRIE.

FLAGSTAFF, ARIZONA,
JUNE 15, 1915.

CRITICISM OF FRENCH FORESTRY [1]

Dr. Martin's critical review of certain features of French forestry, based on actual visits to the most important forests, forms a valuable contribution to French forestry.

It contains a defense of German failures to secure natural regeneration of oak, and attributes the success in France to favorable climatic conditions rather than to high skill in treatment. Possibly one reason why French soil and climatic conditions are more favorable is that they maintain a higher mixture of beech. It is reassuring, however, to see that Dr. Martin thoroughly approves of the use of natural means for reproducing French stands because the method is cheaper and the stand secured is denser and more suitable to the site. American foresters should bear in mind Dr. Martin's admonition that

[1] Heinrich Martin: Mitteilungen über forstliche Verhältnisse in Frankreich. (Forstwissenschaftliches Centralblatt, Aug.-Oct., and Dec., 1908; April, July, and Aug., 1909.)

". . . Natural reproduction is to be recommended where suitable conditions of site and stand occur, and where it is desired to grow the species which occurs on the site."

A great deal has been written of the difference between French and German thinnings in that the French thin more heavily in the upper story (eclaircie par le haut); but Dr. Martin, while remarking on the frequency of cleanings, argues that essentially the German and the French methods are the same, if properly carried out.

After pointing out the large amount of windfall which have devastated French forests, Dr. Martin argues that:

"The French method of grouping must be unconditionally discarded. . . . Natural features . . . afford the best boundaries for the fixed working divisions for the cutting series. In many cases, cuttings have to progress away from them in both directions. In broken topography, the extension of uniform working areas will often be definitely prescribed by the relations of the topographical features."

What Dr. Martin says on the "determination of the cut and the rotation period" is worth careful study. The volume increment, quality increment, as well as the interest paid on the growing stock and the ownership of the land must of course be taken into consideration in determining the rotation. With heavier thinnings, and fewer trees per acre, it would be possible for the French to have shorter rotation periods and higher interest returns. He points out that the French government no doubt can afford to put up with a low rate of interest for the sake of furnishing the class of material most in demand (*i. e.*, large-size saw-logs), yet economic laws are general, and consequently there should be greater uniformity between the methods of management in use by the State and by private owners in France. It is well known that in France private owners are apt to adhere to coppice with standards or simple coppice because of the low interest returns with the long rotation period demanded by the high forest system.

THEODORE S. WOOLSEY, JR.

ALBUQUERQUE, N. MEX.,
APRIL 19, 1916.

SILVICULTURE FOR BRITISH INDIA[1]

This "note" is a substantial publication of 93 large printed pages, divided into three parts. Part 1 includes a general discussion of silvicultural systems as applied to Indian conditions; Part 2, which comprises

[1] "A Note on Some European Silvicultural Systems, with Suggestions for Improvements in Indian Forest Management," by R. S. Troup, Assistant Inspector General of Forests. Superintendent Government Printing, Calcutta, India, 1916.

the bulk of the publication, gives a number of specific examples of the various silvicultural systems as practiced in Europe; while Part 3 gives some examples of and suggestions for systems of forest management in India.

Much of the discussion in Part 1, regarding the application of silvicultural systems in India, is of particular interest so far as the United States is concerned, since in many respects forest conditions and the methods of forest management now applicable here are more or less analogous to those of British India. At the outset, however, the reader is struck by the fact that the author uses the term "silvicultural system" with a much broader meaning than it is used in this country, as is evident from the definition given:

"A silvicultural system is a system of forest management applied with due consideration for the silvicultural requirements of the species, and aiming at the attainment of the normal forest and the establishment of regeneration to the normal extent."

This extension of the meaning of the term to include the establishment of the normal forest, in addition to the securing of reproduction, makes it almost coincident with forest management and greatly widens the scope of the publication. In fact, the greater part of the discussion of Indian conditions deals more with forest regulation than with silviculture, as the latter term is ordinarily used in this country.

Starting with this definition, the author points out that although regular working plan operations commenced in India about 1880, silvicultural systems have in fact not been followed in the preparation and execution of the working plans. Fellings of the selection type have been generally applied, but the author feels that it is a misnomer to refer to these as the selection system, since no attempt has been made to establish the normal forest or to secure systematic regeneration. Indeed, the article of the Forest Department Code governing the preparation of forest working plans in India makes no mention of the silvicultural requirements of the species, the attainment of the normal forest, or the establishment of regeneration to the normal extent. One of the main objects of the present publication is to point out the necessity for a careful consideration of all of these factors in the preparation of any satisfactory plan of forest management.

The author utters a word of warning, which is perhaps needed in this country as well as in India, against adopting too rigid and inflexible a system of management. He points out the possibility that the officer who carries out the prescriptions of a working plan may have more ex-

perience and more knowledge of the species dealt with than the officer who frames the plan, and that, moreover, it is doubtful if the available knowledge of any Indian species is sufficiently complete to justify the prescribing of rigid rules for effecting regeneration. Under these conditions he believes that the officer upon whom the carrying out of the working plan devolves should be given as free a hand as circumstances permit, and should be judged on the results he attains. He calls attention to the fact that even in the highly organized European forests the tendency is toward latitude, and emphasizes the increased desirability of such latitude the more irregular and incompletely stocked is the forest. It would certainly seem that his suggestions along this line are worthy of serious consideration in the United States, where our knowledge both of silviculture and regulation is hardly sufficient to justify us in laying down any hard and fast rules.

So far as rotation is concerned, the author believes that in India financial considerations should be given due weight, provided they do not run counter to silvicultural requirements. He points out, however, that in France financial considerations in their stricter application appear to be deliberately discarded, the avowed policy of the State being to produce large-sized timber on the ground that private persons can not reasonably be expected to do so; and that even in Germany, although financial considerations play an important part, the minute calculation of the financial rotation is not the general rule owing to the fact that market prices many decades hence can not be foreshadowed with any degree of accuracy. The general tendency is to ascertain merely in round figures what rotation is likely to be most profitable. For India he advocates the using of different methods for determining the rotation in the case of natural stands and plantations. In natural stands he assumes that the value of a tree of any size class should be at least as great as that of the size class below it, plus compound interest for the time required for the tree to pass from the smaller size class to the larger. If this test is applied to successive size classes, a point will be reached when it will no longer be found remunerative to hold the trees. In plantations he advocates making an approximate estimate of the rotation on purely financial lines by ascertaining the point at which the annual net rental culminates. It is interesting to note that in doing this he includes the cost of the land as a part of the total cost of formation on the same basis as the cost of planting. This procedure, of course, charges off the entire value of the land during the first rotation, which is contrary to the usual practice in this country and in Europe.

The length of regeneration periods, the fixing of periodic blocks, and the number and nature of reproduction cuttings are discussed at some length. The main conclusion in each case is the advisability of avoiding too great rigidity and of adopting a method of management sufficiently flexible to make changes poossible at any time that experience makes them appear desirable.

The removal of the raw humus in coniferous forests is pointed out as an auxiliary measure that will often be necessary to secure natural reproduction, as, for example, in the deodar forests. The advantage of side protection as against overhead cover as a means of protecting seedlings against damage by drought and frost, and at the same time furnishing abundance of overhead light, is emphasized, as is also the advantage of using fire as an aid in obtaining natural reproduction. The author even goes so far as to state that in the moister teak forests of Burma and in the sál forests of the Duars, prolonged fire protection has produced a condition where reproduction without the use of fire may be regarded as hopeless. Even in some of the coniferous forests of the Himalayas the value of fire in preparing the ground for regeneration has been amply demonstrated.

The author very wisely points out that the whole subject of natural reproduction is intimately connected with a close study of the species concerned in the localities where operations must be carried out. It is to be regretted, however, that he does not emphasize more strongly the necessity for thorough research work along this line as against mere observation of results by forest officers generally.

Artificial reproduction in India is advocated in certain cases, not so much apparently for securing a stand as for increasing the proportion of valuable species, and even changing altogether forest types of little value. He evidently feels that there is a considerable field for artificial reproduction as a supplement to natural reproduction, a conclusion which we will perhaps come to more and more in this country.

So far as regulation of the yield is concerned the author advocates fixation of the annual cut by area so far as practicable, since this facilitates control and simplifies the work. In cases, however, where it is necessary to secure practically equal volumes in the annual cuts, he recognizes that the yield will have to be determined on a volume basis. He suggests that this be done by finding the total volume of all trees over a certain size (usually 3 feet and over in girth), adding to this half the increment during the period, and dividing the sum by the number of years in the period. In practical application the increment is often neglected for the sake of conservatism, and frequent recalculations are made

of the annual cut. In general, the advisability of frequent revisions of working plans is strongly emphasized. For India, in spite of the comparatively small staff available, the author advocates at least partial revisions every 10 to 15 years.

The necessity for taking steps as soon as possible to convert the present irregular forests into normal forests is emphasized, even though this may involve some sacrifice at first. The author also emphasizes very strongly the advisability of concentrating cuttings more than has been the case in the past, and suggests the term "system of concentrated regeneration" to include any form of high forest regenerative operations confined to definite areas as distinguished from the selection type of cuttings which are scattered over the whole forest. Wherever it is possible, however, to employ a definite and well-recognized system over a whole working circle, a more distinctive title would be employed, as, for example, in the case of the clear-cutting system.

Part 2 is devoted to specific examples of the application in France and Germany of various silvicultural systems, of which 11 are given. The very first illustration of the clear cutting of maritime pine with natural regeneration is particularly interesting at this time in connection with experiments now being conducted to determine the possibilities of maritime pine in Florida. The State Forest of Ste. Eulalie, cited in the illustration, is on pure sand which formerly was constantly shifting, and which was reclaimed during the period 1820-64 by the sowing of maritime pine on a large scale. The maritime pine seeds freely every year, and natural reproduction is readily obtained after clear cutting over large areas from seed already on the ground or from felled trees. There is comparatively little risk of fire with the precautions taken, and even when the young crop is burned there is no difficulty in restocking the area by sowing.

Another system of special interest is the so-called "Quartier Bleu" system. This was introduced in France in 1894, and is a modification of the shelterwood system which allows the utmost elasticity in the allotment of periods for regeneration. Assuming, for example, that a forest is to be worked under a rotation of 120 years, and that 30 years is estimated as a suitable regeneration period, the approximate area to be placed under regeneration at one time would be one-quarter of the total. Crops which it is desired to reproduce, and aggregating about one-quarter of the total area, are selected and colored blue on the map (hence the term "Quartier Bleu"). These crops may be in one or a few large blocks, or in several small ones, according to conditions. The remaining area is left uncolored and is termed "Quartier Blanc." At the end of ten years

an examination of the area is made, and if regeneration is complete over any unit, it is thrown out of the Quartier Bleu into the Quartier Blanc, a corresponding area for reproduction being transferred from the latter to the former. Similar allotments are made every ten years, so that although the portion of the area being reproduced at any one time always remains the same, the actual areas change every ten years. The advantage of this system is the great elasticity which it makes possible, and the author believes that it may be found a useful one to adopt in many of the abnormal forests of India.

Wagner's Blendersaumschlag is another comparatively new system which has recently received more or less attention in the United States. An unusually clear description of the system is given by the author, who believes that it may prove of value in India because of the protection which it offers against unfavorable climatic influences. In the case of sál, deodar, Himalayan spruce, and Pinus longifolia, for example, various cases have been noted where reproduction is much more plentiful on areas protected from the sun than on exposed areas.

The other systems covered are the shelterwood system, the group system, the strip system, the strip and group system, the system of wedge fellings, storied high forest, the selection system, and the conversion of coppice with standards to high forest. In connection with the latter, it is interesting to note that the present method of conversion is to allow the coppice to grow up long enough for the shoots to kill each other out to some extent, and for the stools to become so weakened as to be incapable of producing vigorous shoots, before the reproduction cuttings are made. In the early application of the system two of the most serious mistakes made were, first, to clear-cut the coppice and standards and to replant the area, and, second, to clear-cut the coppice and leave the standards as seed-bearers for natural reproduction, such supplemental planting being carried out as was considered necessary. In both cases the cost of keeping down the vigorous coppice shoots and of protecting the young seedlings from suppression was found to be excessive, while in the latter case the drastic opening of the crown cover did not always result in natural reproduction. It is also interesting to note the greater returns received from conifers than from hardwoods. In the State forest of Faye de Montrond, for example, broadleaf coppice with standards is now being converted into high forest of silver fir, with some spruce. Under coppice the forest yielded $1.33 per acre per annum, while after conversion it is expected to yield $11.70 per acre per annum, as estimated on the basis of existing silver fir forests in the neighborhood.

This part of the bulletin is profusely illustrated with excellent photographs of the different systems, which add greatly to the text. The specific examples given include brief descriptions of the geology and soil, climate, and forest, with more extended notes regarding the object of management, the silvicultural system in use, and the method of regulating the cut. In short, this portion of the bulletin forms one of the best compilations in English in regard to the practice of silviculture in Europe, and is well worth the attention of all who desire a clearer understanding of how the various systems are actually applied.

Part 3 contains some specific examples of forest management in several forest types in India, with suggestions for the improvement of these. Especially full descriptions are given in regard to the handling the sál and teak forests. This portion of the bulletin is of less interest to the general reader than the preceding parts, but merits careful study by all who are interested in the present status of forest management in British India.

The general impressions which one gains from this publication are (1) that forest management has not made marked progress in India during the last thirty-five years; (2) that the reason for this is lack of knowledge of the silvical characteristics and of the growth and yield of the species concerned; and (3) that the silvicultural systems developed in Europe should not be applied too rigidly elsewhere. The fundamental principles of forest management are, of course, the same the world over, but the details of their application may, and should, differ under different conditions. A knowledge of what has been done in other countries is obviously suggestive, and therefore useful, but the only firm foundation for silvicultural practice in the United States, in India, or elsewhere, is a thorough knowledge of the silvical characteristics (or ecology) of the various species based on scientific research.

SAMUEL T. DANA.

FOREST SERVICE,
WASHINGTON, D. C.

SOCIETY AFFAIRS

The price of the first 10 volumes of the Proceedings will hereafter be as follows:

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The supply of Volume IX, Nos. 1, 2, and 3, is now completely exhausted, and these numbers are no longer available for sale by the Society.

Attention is again called to the fact that the Society emblem, shown in the accompanying cut, can now be procured by active members. Orders should be sent to the Secretary of the Society, Atlantic Building, Washington, D. C., and should be accompanied by check or money order for $3.25, made payable to the Society of American Foresters.

A special subscription rate of $1 per year for the Proceedings is now open for college students. The directors of the various forest schools have been requested to bring this offer to the attention of the student body. Students' subscriptions should be forwarded to the Secretary of the Society through the directors or professors of the schools.

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Field Meeting of the Society at Asheville, N. C.

A field meeting of the Society was arranged for July 14 in the Pink Beds of the Pisgah Forest in connection with the Southern Forestry Congress. On account of rain the presentation of papers and an examination of the old cuttings had to be postponed, and the meeting on a whole was not as fully enjoyed as it might otherwise have been. There were 21 members of the Society present at the meetings of the Southern Forestry Congress. This Congress, which was held at the Battery Park Hotel at Asheville, N. C., consisted of a series of meetings extending from July 11 to 15, inclusive. The Congress was organized under the auspices of the North Carolina Geological Survey, and in addition to the

Society of American Foresters a number of other societies participated in it, namely, the North Carolina Forestry Association, Association of Eastern Foresters, American Forestry Association, North Carolina Pine Association, and Appalachian Park Association.

Among the notable addresses were those by H. S. Graves, "The Southern Forests and Their Place in the Nation's Timber Supply;" "Biltmore Forest and Forest Plantations," by Verne Rhoades; "A Practical Example of Forest Management in Southern Yellow Pine," by Henry E. Hardtner; "The Erosion Problem of the South and Its Relation to Forestry," by R. S. Maddox; "Organization of State Protective Systems," by H. H. Chapman; "What the States Can Do in Forest Fire Protection," by F. W. Besley; "Publicity and Education in Forest Protection in the South," by J. E. Barton; "The Regeneration of the Southern Pine Forests," by J. W. Toumey; "The Naval Stores Industry; How It Can be Perpetuated in the South," by I. F. Eldredge; "The Forests of the Future—Second Growth," by W. W. Ashe.

The attendance aggregated about 150 persons, from a fifth to a fourth of whom were local residents of Asheville and vicinity. The delegates hailed from 20 different States. Before adjournment the organization was made permanent, and Dr. Joseph Hyde Pratt, State Geologist of North Carolina, was elected President, with J. S. Holmes, State Forester of North Carolina, Secretary. In addition, the President was given authority to appoint an executive committee of seven members and vice-presidents to the number of 15, one from each of the Southern States.

Sixteen moving-picture reels dealing with forestry subjects were shown daily throughout the week of the Congress. This was made possible through the cordial co-operation of the Forest Service, several State Forest organizations, the Milwaukee Journal, and the Southern Pine Manufacturers' Association in the loan of films, and of the S. A. Lynch Enterprises in the display of these at their three moving-picture theaters.

While not on the program, the feature which doubtless claimed a very large measure of attention of the delegates to the Congress were the floods which began at the close of the Congress, and provided a sad but impressive lesson of the havoc which uncontrolled precipitation may work.

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Vol. XI OCTOBER 1916 No. 4

CONTENTS

South American Forests ..... H. M. Curran 369
Forest Problems and Economic Development in South America ..... Raphael Zon 375
Utilization and Round-Edge Lumber ..... R. T. Fisher 386
The Natural Root Grafting of Conifers ..... Harold S. Newins 394
Slash Pine—An Important Second-Growth Tree ..... Wilbur R. Mattoon 405
Comparative Test of the Klaussner and Forest Service Standard Hypsometers ..... Douglas K. Noyes 417
Dollars and Sense ..... Donald Bruce 425
Comment ..... F. E. Olmsted 428
Evaporation and Soil Moisture in Relation to Plant Succession ..... Clarence F. Korstian 430
Silvical Notes on Western Larch ..... J. A. Larsen 434
Scientific Notes and Comments:
What About Sites? ..... A. B. Recknagel 441
The Effect of Wind ..... C. G. Bates 443
Silviculture and Grazing Combined 444
Comparative Value of Burlap and Pine Needles as a Mulch 446
A Russian National Conservation Commission 446
Reviews:
Seeding and Planting in the Practice of Forestry ..... C. R. Tillotson 448
..... Raphael Zon 453
The Vegetation of a Desert Mountain Range ..... G. A. Pearson 455
Philippine Dipterocarp Forests ..... H. N. Whitford 463
Life History of Shortleaf Pine ..... Francis Kiefer 469
Shortleaf Pine—Its Economic Importance and Forest Management ..... Francis Kiefer 470
Society Affairs 473

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Papers that have already appeared elsewhere will not be accepted for publication. Simultaneous publication in another journal will not be agreed to.

Manuscripts may be sent to any member of the Editorial Board and should be clearly typewritten and in suitable form for printing without essential changes. Footnote references should be complete, including year of publication.

The Editors reserve the privilege of returning to the author for revision approved manuscripts and illustrations which are not in proper finished form for the printer, or, if the author so desires, the Editors will have the manuscripts and drawings prepared and charge the author the cost of this work.

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SOUTH AMERICAN FORESTS

By H. M. Curran

Wherever man has come in contact with forests, from the edge of the Arctic snows to the heart of Matto Grosso, they have ever been his friend and he the forests' worst enemy. Man in the primitive or pioneer stage loves trees but hates forests. Even civilized man, if town bred, enters the great forests with a vague feeling of dread and returns to the sunlit open fields with much the same feeling as a prisoner set free after long confinement. This fear of the forest and its hidden dangers makes man look with indifference on damage done by fire and axe. With these two implements he has been able to master the vast areas of coniferous forests in the temperate zones and with the aid of horse and plow has driven them to swamp, ravine, and rocky mountain tops.

The conifers and temperate hardwoods have been conquered, destroyed, or became the servants of man; the great forests of the tropics have just begun to know and fear his power. Primitive communities have for thousands of years fought a losing battle with the jungle; the gains of one generation are often lost by the next. As a rule, only along the principal railways has man obtained a foothold, and even here the jungle often presses at the gates of his towns.

Of recent years medical science has robbed the tropical wilderness of its most deadly weapon, and for the first time in history man has it in his power to destroy or bend the jungle to his will. With this new-gained advantage man is busy today with fire, axe, sawmill, and plow wasting the wealth stored for centuries in the most wonderful and most beautiful forests in the world. The value of temperate forests is as nothing compared with the producing power of equal areas in the tropics. These

areas produce rubber, rattan, dye, tannin, vegetable ivory, medicine, fibers, oil, resin, and bamboo, in addition to the wood products from trunk and branch. Higher prices can be obtained for tropical than for temperate woods, and, as a rule, growth is much more rapid in the south. It is possible for the tropical forester to plant and harvest not one, but many forest crops in a lifetime, with a higher return per acre for each than the single crop of the forester in Europe or the United States.

Firewood can be grown in from three to five years; pulpwood, posts, and piles in 10 to 15. Timber of 18 to 30 inches in diameter can be produced in 15 to 25 years, and the minor products of his forest may yield more than the timber itself. For every dollar of wealth produced by temperate forests tropical forests should yield not less than ten.

In the face of this great potential wealth tropical forests are being destroyed wholesale to produce crops of little value and the fields themselves often abandoned in a few years.

Fire is the most destructive of all man's weapons against the temperate forests and is also his means of reducing the jungle. To be effective he must use machete and axe to destroy the timber, as fires will seldom run in forests with abundant and evenly distributed rainfall.

As a rule, all agriculture practiced in the tropics has as its first step the clearing and burning of an area of timber. Few people realize that each bag of coffee, pound of chocolate, or bunch of bananas represents many thousands of feet of timber reduced to ashes, and that the "crop burned" is often of more value than the one harvested.

We passed through a similar stage of development in the United States; cotton, tobacco, wheat, and corn were first raised on lands from which the planters removed by burning millions of feet of choice white oak, hickory, ash, walnut, and pine. It is hard to excuse this waste, even in pioneer days, in lands without transportation, and can only be condemned when allowed by a nation today. The world needs vast quantities of wood, and no spot of the earth with abundant forest wealth is too remote to prevent a profitable harvesting of the timber crops. Quantity of the product, coupled with size and quality, are the only factors determining or limiting the degree of utilization.

With the exception of two small regions, South American forests are of broad-leafed hardwoods. From the point of view of forester or lumberman, these forests differ little from the hardwoods of our mountains and the Mississippi bottom lands. Here and there exceptional stands are found, but on the whole these forests run from 10,000 to 20,000 feet board measure to the acre. The common belief that tropical forests contain only very hard woods must also be dropped, for recent investigations

show these forests to be composed of soft or medium hard woods, which are as suitable for general construction as the pines and various conifers and hardwoods of our own forests.

South American forests may be roughly divided into four more or less distinct types, the species composing each varying from region to region, but the general effect of each type from Columbia to Argentina is much the same. The four principal types have, for convenience of description, been given the following names: Dry Forests, Temperate Forests, Swamp Forests, Tropical Rain Forests. Better or more scientific names can be found and will come from the careful study now planned for these regions. Many minor yet distinct types must be passed over in this general survey. The conifers of northern Patagonia belonging to the Temperate Forests and the Brazilian conifers of the transition zone between Temperate and Rain Forests are among the most interesting of the lesser types.

Dry Forests

In the temperate or subtropical regions, both at high and low levels, there are immense areas where the rainfall is deficient or so unevenly distributed throughout the year as to cause long periods of drouth. These areas are usually covered with some form of tree growth which at its best is a dense forest of comparatively few species. The trees are short boled, round headed, often armed with spines or thorns or soft spurs like branches and harsh or bristle-pointed leaves. The trees usually do not exceed 50 feet in height, and in many regions the average is little over 25 feet. The commercial stem varies from 10 to 20 feet, with diameters of 12 to 24 inches common. These forests grade into chaparral on one side and on the other into Tropical Rain Forests. Perhaps the best-known representatives of this type are the Quebracho-Algarioto forests of northern Argentina. They occupy the great semi-arid plain lying between the foothills of the Andes and the Parana and Paraguay rivers and known as the Great Chaco. Other representatives of this type are the Catinga forests of Brazil and the Coast forests of Colombia and Venezuela between Cartagena and the Island of Trinidad.

Temperate Forests

This second type is found along the slopes of the Andes, where elevation and moisture combined with suitable soils make the growth of a temperate forest possible. This type is best developed in Patagonia and comes practically to sea-level in Tierra del Fuego. Here in the south the trees are rather stunted and deformed by the winds, but in the mountains to the north and along the shore of the Patagonian lakes they reach a splendid development and heavy stands are reported. These forests are

of Antarctic beech and a few conifers. Three species of the beech would probably furnish 90 per cent of the cut. Average stands are probably between 10,000 and 20,000 feet per acre, not allowing for defects. The forests are overmature and so defective as to be of little commercial value. The trees reach heights of 100 to 125 feet and are 2 to 5 feet in diameter. The extension of this type along the Andes from Chili to Colombia can only be estimated. The great populations that have for thousands of years occupied this region drew on these forests for fuel and construction timber and only second growth or scattered patches remain. These highland people have even worked down to the edges of the Rain Forests of the great Amazonian plain.

Swamp Forests

This type, the third of the great divisions, may be divided into two subtypes—the tropical forests, occupying the salt-water swamps at the mouths of the great rivers forming one section, and the forests of the fresh-water swamp and bottom lands the other. The tidal swamp forests are typical mangrove areas like those found in other parts of the world and are rather restricted in area and practically destroyed. The fresh-water swamp forests occupy great areas and promise to be of commercial importance in the near future. The best-known representatives of this type are the lowland forests that fringe the Amazon, the Orinoco, Parana, and Magdalena rivers. These forests are similar in character, though differing in species from north to south. Many closely related species are found in all these forests and only the botanist would note a difference.

The overflowed areas along the river are a series of sandy or gravelly bars, small islands, sandy banks, wet open meadows or savannas, shallow ponds and lakes, and a network of minor waterways. They vary from a few miles in width to perhaps a hundred or more. At least once a year they are covered with water, with the possible exception of the very highest points. The rise of the water may be rapid or slow and remain a few hours or even months in the deepest part of the ponds and lakes. Usually the rise is gradual, the water flows through the many channels, fills ponds and lakes, and spreads thence to the forest, as in our own bottom lands. The water then gradually subsides, and only the deepest ponds and lakes and channels retain water during the drier period.

The forests of this area are very irregular in age, often very open, and growth is extremely rapid. Changes are so rapid in this region, each freshet making new land and destroying old, that only fast-growing species can obtain a footing over much of the area. The species common in this type are in the main soft wooded, as soft or softer than our cotton-

wood, basswood, and yellow poplar, and many with but little color. They reach heights of over 100 feet in the best soils; probably 60 to 70 feet is an average, with diameters of 2 to 3 feet common. Certain of these species reach this height in 10 to 15 years and commercial diameters in much the same time. The dominant stand for any given region is usually of a very few species. In many cases four or five varieties of trees will furnish 75 per cent or more of the commercial timber and the yield be 8,000 to 10,000 feet per acre.

Tropical Rain Forests

This is the most important and the least known of all the types of South American forests, and, though it may seem paradoxical, yet its timbers are among the best known tropical woods. Mahogany, rosewood, Spanish cedar, Brazil wood are the products of these forests; but as only the edges of the great wooded areas have been reached by the lumberman and explorers, and even the Indians keep near the waterways, they may be said to be practically unknown.

This forest type in South America is probably the largest and most valuable body of timber in the world today. South America's future and many of the great problems of forest administration in Europe and North America depend on how this forest is treated. If it is destroyed, as the forests of Argentina, Paraguay, and southern Brazil are being destroyed, it will mean economic ruin, probably also absolute physical ruin to land, climate, property, and life on a great part of the southern continent. If, on the other hand, it is protected and properly utilized, South America becomes the center of the world's prosperity in the years to come. The saving of this forest means also that Europe and North America will have time to repair their damaged forests, to perfect their organization, so as to meet demands without destroying the capital. Only by obtaining great supplies from these virgin forests of South America can this crucial time in the great struggle for forest conservation be safely passed. If, therefore, these forests are so valuable, can they supply at once the kind of timber demanded, or must the world learn to use new forms to supply its needs?

The Tropical Rain Forests are composed of timber practically like those now in use and in most cases much better adapted for the uses to which they will be put than those now supplied by the American mill man. The time will come when we will look back with amusement to the dark ages, when we used yellow pine for boxes and railroad ties and redwood for shingles and vineyard stakes.

The woods of these tropical forests are in the main soft or of medium hardness and are suitable to replace pine for construction, oak for finish and furniture, hickory for wheels and handles, and ash for agricultural implements. From the infinite variety of these timbers we can find one for each industry more completely suited to its needs than the ones used today. From the point of view of the logger, these forests are ideal. Heavy stands are found over great areas on land as level as the southern pineries. Ten to twenty thousand feet can be cut to the acre. Commercial diameters run between 2 and 3 feet and the clear lengths 50 feet or more. The total height of an average tree is well over 100 feet.

Navigable rivers and streams reach every part of the forest and short hauls to floatable water will be the rule. Much of the timber will float; but it is quite probable that it will be found most profitable to construct complete wood-working plants close to the forest, dispose of low-grade products near at hand, and ship only more or less finished products to the world's markets.

South America has this most wonderful opportunity of becoming the center of the world's lumber industry. If the various governments will organize forest services, train their young men as foresters, the wealth of these regions will flow into their treasuries and not be wasted as they are today.

FOREST PROBLEMS AND ECONOMIC DEVELOPMENT IN SOUTH AMERICA [1]

By Raphael Zon,

Chief of Forest Investigations, Forest Service

The physical conditions of South America clearly indicate that her great future lies not so much in manufacturing industries as in the development of her agricultural, timber, and grazing resources. South America's natural resources form the basis of all her future development; their conservation, therefore, must be a matter of great national concern. Intelligent utilization of any natural resource requires an intimate knowledge of its nature and extent, its possible uses, and, in the case of a renewable resource, such as forests, the method of its perpetuation. This means the application of scientific methods to the study of these resources. As has already been demonstrated in many of our industries, this is the only truly practical way of approaching any problem.

Of these resources the forest must be considered among the most important, both because of its extent and because of the wealth of species and the many valuable by-products, such as rubber, dyestuffs, tannin, and other substances which are derived from the tropical trees. The forest area of South America forms about 38 per cent of the total land area, and in its vastness exceeds anything known in North America or any other continent, with the possible exception of the Russian taiga in Asia.

Probably in no other country in the world do there exist such vast possibilities for forest investigations as in South America, which has forests of every kind, from the moist, damp vegetation of the tropics to the coniferous forests of southeastern Brazil and of the Andes, between which is found every intermediate vegetation.

To show how the application of the science of forestry may be helpful in the development and in the conservation of the forest resources of South America, it is necessary first to understand the nature of the problems involved. The forest problems of South America are intimately bound up with the function of the forest:

1. As a source of raw material.
2. As a regulator of streamflow.
3. As a regulator of climate.
4. As an object of silvicultural management.

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[1] Read before Section III, Second Pan-American Scientific Congress, January 5, 1916.

1. *As a Source of Raw Material*

The most obvious and perhaps the most important function served by the forest is to supply raw materials used in the industries. In temperate countries wood is, of course, the chief material produced, its by-products, such as turpentine, bark for tannin, or sugar, being of minor importance. In tropical forests, however, the by-products, such as rubber, dyestuffs, and tannic acid, are frequently more important than the wood itself.

South America, as a whole, is deficient in coal deposits and other mineral fuel and possesses only a limited and localized source of water power. Wood, therefore, must be not only the chief source of building material, but also the main source of fuel in a large part of the country. The kind of wood which is most in demand at the present time for general use is a light, strong, easily workable timber which can be supplied in large quantities at a comparatively low price. The value of the South American forests depends both upon the number of species which can be found to possess such properties in the wood as will render them useful for many purposes and upon the discovery of other properties whose chief value will lie, as in the case of quebracho or brazil wood, in the tannin, dyestuff, or other chemical substances needed in industries. It would seem, therefore, that a survey of the forest resources of the country is necessary, together with a thorough study of the different species composing her forests and of their technical properties. The tropical forests of the Philippine Islands are a good illustration of the wisdom and practicability of such a study. A few years ago they were considered by many of little commercial value because of the difficulty and costliness of logging vast areas for a few valuable species that might be found scattered through them. Closer acquaintance with the species and a study of their properties disclosed the fact that the forests of the Philippine Islands and the entire Indo-Malay region contain a large number of species, originally considered forest weeds, which possess all the qualities of the temperate hardwoods that are so extensively used for interior finish, furniture, and similar purposes. The discovery of a large number of such species made profitable the exploitation of the tropical forests because of the heavier cut per acre, and placed the entire tropical forests of the Philippine Islands and Indo-Malay region on a new commercial basis. Even if the tropical forests of South America should never become the source of timber supply because of the weight of the wood and difficulty of lumbering, they still represent an enormous wealth because of their richness in by-products. The field opening out in the study of the commercial value of the different by-produces of the tropical forests is of almost incalculable extent and of the highest pecuniary value. The in-

vestigations may include the study of the properties of the oils contained in woods and in the bark and seeds; of the tannins and gums and their marketable supply; of seeds and fruits, such as Brazilian nuts or sapucaia (*Lecythis ollaria*); of Piassava palm fiber for the manufacture of brooms and brushes; softwoods for the manufacture of paper, matches, etc.; of bamboos for paper pulp, umbrella handles, sticks, canes, and fiber; of dye woods which before the discovery of the cheaper aniline dyes were among the most valuable products of the country, and so on.

A very striking example of the value of scientific research in the exploitation of natural resources is the discovery by a research staff at Periadeniya, Ceylon, of wound response in Hevea rubber trees—a genus which also occurs in South America. It was found that the production of latex is greatly stimulated in the immediate neighborhood of wounds, so that by continuing to tap successively on the edge of existing wounds a greatly increased yield is obtained. The recent enormous improvement of the rubber industry in the East and the high yields obtained are largely, if not entirely, the outcome of the discovery of this simple phenomenon of wound response.

The direct financial results secured from the application of the scientific discoveries made by the U. S. Forest Service fully justify expenditures for research work in the field of forest utilization. Thus, through the work of the Forest Products Laboratory, the solution of the problem of prevention of sap staining of lumber secured a saving to the lumber industry of over eight million dollars annually; pulp and paper investigations within recent years have shown the value of about thirteen species of American timber for the manufacture of ground wood pulp; the studies in the distillation of hardwood timber showed that with no increase in the cost of equipment or operation of a commercial plant the yield of wood alcohol and acetate of lime may be increased approximately 30 per cent and 15 per cent respectively. One company which adopted the new method has demonstrated that it could save by this method over forty thousand dollars a year. The data secured by tests of the mechanical properties of wood are being used as a basis for grading structural timbers for a revision of building codes by engineers and building contractors employing structural material and in employing the proper design for a great variety of products, such as spokes, wheels, boxes, etc.

If forest investigations in such a country as the United States where the trees are comparatively well known and have been for a long time used in various industries are capable of increasing enormously the usefulness of the woods and the products that may be derived from them, how much greater field, then, exists in South America where the species are hardly known botanically.

2. As a Regulator of Streamflow

The function of the forest in regulating the flow of streams is second in importance only to its function as a producer of wood and other raw materials. On the one hand, it prevents such calamities as floods, erosion, and silting; and on the other, it conserves the water for domestic use, irrigation, power, and navigation.

It is now a matter of pretty general agreement that the forests in a mountainous country are conservers of water for streamflow; that they increase underground storage of water to a larger extent than any other vegetable cover, and that although forests cannot prevent floods, which are produced by exceptional meteorological conditions, they tend to lessen their severity and destructiveness. The function of the forest is undoubtedly as important in South America as in any other country. Mr. Bailey Willis, as a result of several years of study and exploration in northern Patagonia, unreservedly states that the important service for which the Andean forests should be conserved is that of regulating the streams which flow from the Cordillera across the eastern semi-arid region of central Argentina. They cover the mountain ranges, where the annual precipitation is very heavy, a large part of it falling as snow. The dense growth of the Andean beeches and cedar protects the ground and prevents the rapid run-off in the streams. Even as it is, there are great floods and in summer corresponding scarcity of water. But if these forests be stripped from the steep slopes of the Andes the floods will be greatly aggravated and the waters available for irrigation will be so diminished that the valleys, which should become the seat of a dense and prosperous population, will be left to the solitary sheep-herder and his flocks.

What is true of Argentina is equally true of Chile. Half the land now cultivated in Chile is watered artificially, and much of the land waiting to be planted must be irrigated before it will yield profitable crops. From Coquimbo to the Bio-Bio River the extent of cultivated areas and the yields of crops depend largely on the supplies of water for irrigation. A beginning has been made of storing water and of constructing engineering works for its distribution. Large irrigation projects, in most cases involving storage dams in the Andean Valley, would make available for crops extensive areas not now planted. Although many of the streams are snow fed, the ruggedness of the mountain slopes makes the danger of erosion and the destruction of the low-lying fields, in case the forest is removed, extremely great.

In discussing the water-power of the Cordillera, Mr. Bailey Willis states again that the effect of the forests in regulating the flow of the

rivers in the Cordillera is equivalent to the conservation of 1,700,000 horse-power, which, in view of the industrial future which the region will have, may be capitalized at $170,000,000 gold. In the valley of the Rio Negro the government is now spending many millions in irrigation works, and the lands under irrigation are valued there at more than 200 pesos paper per hectare. That development is founded on the waters of the river, which in turn depends for its regular flow on the forests.

Water-power is now being developed in numerous places also in Chile. The amount of water-power in Chile is enormous, and in the absence of mineral coal the introduction of cheap hydro-electric power is essential to the development of manufacturing industries already established in a number of centers; and the forests are just as indispensable for the proper utilization of this enormous water-power as for irrigation works, yet large areas originally forested have already been cleared for crops, especially in the valleys. As a result of lumbering the actual forest area has been reduced to 75,000 square miles, or about one-fourth of the country.

The importance of the forests for the irrigation and water-power interests of South America, as well as for the control of floods, makes the protection of all critical watersheds a matter of imperative necessity. No country can develop a sound national forest policy which does not take into account the protective value of the forests, or lacks knowledge of where the forests are located or the extent of their influence. The influence of the forests upon the regulation of streamflow is no longer a theory. The experience of the old European countries—France, Switzerland, the Tyrol—furnished conclusive proof of the effects that follow forest destruction and the enormous expense involved in attempting later to correct the evil. In the United States of North America the service which the National Forests alone perform in the conservation of water for irrigation has been estimated at 2½ million dollars annually. As a matter of fact, one of the main purposes for which part of the public domain has been set aside as National Forests and for which $11,000,000 have been appropriated by Congress for buying private forests is to secure favorable conditions of water flow.

3. *As a Regulator of Climate*

The forest has also a marked influence on the climate of the area occupied by it and that of the territory in the lee of it.

There is a close relationship between the climate of the country and the extent and distribution of its forests. On a continent a large portion of which is in the tropics and which abounds in low land, such as the

Amazon basin, the part which forest plays in the climate and the salubrity of the region is of vital importance. South America in the general outline of its continent and distribution of the principal mountain ranges resembles very closely North America. Like North America, it is wide in the north and narrows down toward the south and has a similar arrangement of its principal western mountain ranges; in the east there is a close similarity in the arrangement of the secondary mountain ranges; thus the Brazilian highlands correspond very closely to the Appalachian Mountains and the Guiana Plateau to the Canadian Plateau. There is no other continent on which the climate retains a maritime character for such a long distance from the shore as that of South America, between 10° of northern latitude and 20° of southern latitude, and from the shores of the Atlantic to the eastern foothills of the Andes. This climate is without doubt due to the prevailing moist easterly winds which pass over the vast forest area and cause most of the rainfall. There are many reliable indications that the forests in the path of the prevailing moist winds play an important part in causing the moisture to be carried farther into the continent. When moisture-laden winds from the Atlantic Ocean reach the land and encounter irregularities, they are cooled and begin to lose part of their moisture in the form of precipitation. As long as the air currents remain saturated with moisture the slightest cooling or irregularity of the land that causes them to rise will result in precipitation; but as they move inland and become drier the remaining moisture is given off with difficulty and precipitation decreases. The sooner the humid air currents over land are drained of their moisture the shorter, of course, is the distance from the ocean over which abundant precipitation falls. If precipitation over land depended solely upon the amount of water brought by the prevailing winds directly from the ocean, rainfall would, of course, be confined to a narrow belt close to the sea. Not all the water that is precipitated, however, is lost from the air current. A large part of it is again evaporated from the land into the atmosphere. The moisture-laden air currents, therefore, soon lose the moisture which they obtain directly from the ocean, but in moving farther into the interior absorb evaporation from the land. Hence the farther from the ocean the greater is the proportion which evaporation from the land forms of the air moisture. In fact, at certain distances inland practically all the moisture of the air, or at least as great a part as that formed originally by the water evaporated from the ocean, must consist of that obtained by evaporation from the land. It has been shown beyond any doubt that the evaporation from a vegetative cover, especially a forest cover, is greater than from a water surface or moist, bare soil. The enormous amount of moisture which a forest gives off into the air may be

compared to clouds of exhaust steam thrown into the atmosphere and must necessarily play an important part in the economy of nature. The prevailing easterly winds, taking up the moisture given off by the forests, carry it further into the interior and thus bring about a more uniform distribution of precipitation over the continent. This effect of the forests in the path of prevailing winds may probably be found in the case of the forests of the coastal plain of North America which lie in the path of the prevailing moist southerly and southeasterly winds blowing from the Gulf of Mexico, and probably hold equally true in the case of the forests of Sweden, which lie in the path of the moist easterly winds of Europe, and which therefore must have an important influence upon the precipitation of the countries to the east of it.

A well-known meteorologist, Woeikov, has shown that the amount of water given off by tropical forests into the atmosphere is enormous, and that this evaporation to a large extent explains why in the vast tropical forests of the Amazon River the temperature of the air never becomes as high as it is, even in middle latitude. According to Woeikov, the middle and upper extensions of the Amazon River are about 621 miles from the Atlantic Ocean and are separated from the Pacific Ocean by very high mountains. At such great distances from the ocean and so close to the equator, one would naturally expect to find very high temperatures and great dryness. Yet there the average temperature of the warmest month and the absolute temperature maxima are not greater than at the sea, and even not as high as the temperatures often experienced in middle latitudes. In the following table is shown the temperature and relative humidity at different points within and outside of the Amazon River basin:

Temperature and relative humidity in Amazon River basin and at points on or nearer the coast

Locality.	Altitude.	Latitude.	Distance from Atlantic.	Mean annual.	Temperature average for the warmest month.	Absolute maximum.	Annual mean relative humidity.
	Feet.	°	*Miles.*	° *F.*	° *F.*	° *F.*	*Per ct.*
Para	....	1½	62	80.6	81.86	.....	...
Manaos	121	3	714	78.98	80.6	97.26	80
Iquitos	311	3½	130	76.64	78.26	90.32	83
Pernambuco ...	11	8	...	78.26	80.78	89.06	72
San Antonio, on the Madeira..	....	9	1,087	78.8	80.6	.....	...

Woeikov attributes this remarkably moderate temperature of the Amazon River basin to the cooling effect of the forest. He assumes that in tropical countries covered with luxuriant forest vegetation the rainfall is seldom less than about 60 inches a year. So thick is usually the mass of decayed leaf litter and fallen and half-rotted trees in the forest that most of the rainfall is absorbed by the soil, and only a small portion runs off from the surface. Even allowing one-third of the annual precipitation for surface run-off, there is still transpired by the plants and evaporated by the soil a layer of water about 50 inches high. About 35.5 cubic feet of water are given off from every 10.7 square feet, and in the evaporation of this amount of water 606,500 calories of heat are consumed. It is self-evident that the absorption of such enormous quantities of heat from the atmosphere must tend to moderate the temperature prevailing in the Amazon basin.

4. *As an Object of Silvicultural Management*

Studies of the commercial value of the South American timber resources and of the effect of forest cover upon climate and streamflow will provide a basin for determining the national economic importance of South America's forest wealth. There still remains, however, the entirely untouched field of the actual management of the forests, of how to grow and care for the forest, how to perpetuate the valuable species and eliminate the inferior ones, and increase in general the productivity of the forest. There are constantly growing fears that if the present methods of cutting quebracho forests are not modified and measures are not adopted for its regrowth there will be little left of them in a very short time. The same is true of the green heart and of the mahogany, of the Spanish cedar and Parana pine, and of other valuable South American species. To work out methods of proper forest management for such a large number of species as are found in most of the South American forests, one must not only know them botanically, but must also know their life histories, their requirements for light, soil, and moisture, their enemies, and diseases. This is a field in which practically nothing has yet been done in South America. Even the botanical identity of some of the commercial woods is not fully known, still less their distribution, their growth, and life requirements. Yet the climate of South America, at least of the Amazon basin, affords the most wonderful opportunity for growing timber crops of the most valuable kind. In such a climate the practice of forestry in the Amazon Valley could bring forestry nearer to the level of an agricultural crop than anywhere else. While in the north and temperate regions it takes many decades for a timber tree to reach

usable size, in the moist and warm climate of the Amazon Valley this could be accomplished within probably 25 or 30 years.

It is impossible to go on with the improvements of the forests or to begin planting pure stands of some valuable species and overlook the danger to which they may be exposed from insect depredations or attacks by fungous diseases. Research alone can render us prepared against such depredations, and it is only when the life history of the insects and the fungi is known that means are found for combating them.

The solution of the forest problems outlined here cannot be accomplished, of course, in a year or two years, even with concentrated efforts. In attempting such investigations it must be borne in mind that a narrow-minded view that one dollar spent on Monday should produce two dollars on Tuesday is an unreasonable one. The time taken for forest research to show a monetary profit must of necessity depend on the subject dealt with. The ultimate gain to the country through the appreciation of the economic importance of the forest and the adoption of rational methods of forestry has been amply proved in Europe and the United States of North America. The adaptation of similar methods to the varying conditions of climate and vegetation in South America, wherever they can be successfully introduced, is a matter of the greatest importance from a financial standpoint, and expenditures on forest research are more than justified.

Europe and the United States also point out the way to approach scientifically the solution of the forest problems. It has been the experience of all the countries which attempted to place the exploitation of their forests on a scientific basis that this can be best accomplished only by means of forest experiment stations. Forest experiment stations have accomplished for the science and practice of forestry what the agricultural experiment stations have accomplished for the science and practice of agriculture. If the experiment station idea has been found essential in the study of agricultural crops which are, as a rule, plants with a short cycle of life and therefore lend themselves to short-time observations, how much more essential is the experiment station idea in connection with timber trees whose life cycle extends over a number of decades and often over several generations of men. The experiment station idea really means nothing else but systematic observations over a long period of years properly recorded and properly interpreted by an especially trained and scientific staff instead of sporadic observations without any system or organization.

The forest experiment station idea is not a new one. The value of the systematic organization of forest research work was officially recognized

in Germany in 1870, when the first forest experiment station was established in Baden in connection with the Polytechnikum at Carlsruhe. Half a dozen of the German States followed the example, instituting main experiment stations in connection with forest schools and branches in various forest districts. The cost to the German Government is in the neighborhood of $30,000 annually. The work done is intensely scientific, and the policy of forest experiment stations is steadily growing in favor. In India, where the work of research has been neglected for a long time, the need for scientific investigation has now been recognized by the government, and an Imperial Forest Research Institute and College has been created at Dehra Dun, with a faculty chosen from the Imperial Forest Service. In the United States considerable research work has been done in connection with forest problems. The beginning of real investigative work in silviculture, however, must date from the establishment of the first experiment station, at Flagstaff, Arizona, in the summer of 1908. Advantages of economy and greater efficiency in conducting investigative work in silviculture at an experiment station are apparent. Under the old system of conducting investigative work, assignments to an extensive area were usually necessary, to which the observer could devote but a short field season. Under the system of forest experiment stations, specially trained men are permanently assigned to a given region, with which they have an opportunity to become thoroughly familiar, and therefore are capable of conducting the work with the greatest effectiveness and least expense. Each of the experiment stations is allotted an area sufficient for the proper handling of short-period experiments, for experiments requiring a number of years, and for the maintenance of large permanent sample areas, which serve as models typical of the silvicultural region. Such areas furnish the most valuable, instructive, and convincing object lessons for the public in general, for professional foresters, lumbermen, and owners of forest land, and especially for the technical and administrative officers of the National Forests.

The organization of the forest experiment stations made possible the use of uniform methods in dealing with forest problems. General problems are treated at the different stations simultaneously; local problems in the region to which their results apply. All of the modifying factors which enter into the results of experiments are measured by observations covering many conditions and years and are thus determined once for all with the greatest economy and the least duplication of work.

The stations are distributed in such a way that one station is located in each of the silvicultural regions of the West. A single forest, representing as much as possible the conditions typical of the region, is selected

and a portion of this area set aside for the purposes of the experiment station.

The United States Forest Service is now maintaining a large and well-equipped laboratory in forest products at Madison, Wisconsin, three forest experiment stations in the central and southern Rockies, two in the Sierras, one in northwest Idaho, and one in Oregon. In addition one experiment station is being maintained in Minnesota in co-operation with the University of Minnesota.

The establishment of experiment stations and inauguration of research work in forestry, however, is impossible unless there exists some forest organization in each country for the protection and administration of at least the government timber resources. Before scientific work can begin there must be an awakening of public opinion to the importance of forest protection in general, the value of the forests to the nation, and the need of developing better methods for their perpetuation. Unless such investigations are backed up by an awakened public opinion, and there are various government organizations which can utilize the discoveries of the scientific staff and apply them to the actual exploitation of the natural resources, the investigations will remain largely academic without any practical significance and will accomplish comparatively little good. Fortunately for most of the South American countries, much of their timber is still in the hands of the government, and therefore the opportunities for developing a national Forest Service to undertake scientific investigations in the various forest problems are good. In some countries—Argentina and Chile—the first beginnings in this direction have already been made.

UTILIZATION AND ROUND-EDGE LUMBER

By R. T. Fisher,

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The closest utilization of saw timber so far developed in the United States is practiced in the woodlot region of central New England. Southern New Hampshire and north-central Massachusetts contain some of the chief centers for a wide variety of wood-using companies, whose products include boxes and box-shooks, match-blocks, sashes and blinds, woodenware, furniture, toys, and novelties. Among them these companies use practically every species native between Connecticut and the Canada line, and the amount of their annual consumption runs to several hundred million of feet. In the town of Gardner, Massachusetts, for example, the furniture factories use at least 25 million a year, nearly all of it hardwood. The consumption of pine for the general locality in question is at least double that of hardwood. The lumber supply for this market comes principally from New England and northern New York, but a considerable percentage of the higher-priced stock, both hardwood and softwood, comes from as far south as Virginia and Tennessee and as far west as Idaho and Washington. This latter is bought and sold "on grade"—that is, according to the standard inspection rules of the wholesale market for the particular species. The native and relatively locally grown lumber which makes up the bulk of the raw material is not and cannot be marketed according to definite specifications. This is because it is almost universally sawed into waney or round-edged boards, which may vary very widely in respect to such qualities and defects as grading rules usually specify without losing their suitability for use in a given industry.

The round-edged board came in with the manufacture of commodities made of small and varied parts of standard sizes. It has made possible a utilization that is very nearly complete, and has resulted, both in the woods, the sawmill, and the factory, in a yield of usable lumber per unit of cubic log-contents that is greater than under any other existing saw practice. It has also brought with it a method of log and board measurement which, while apparently simple and uniform, is actually complex and variable, both in its relation to cubic volume and to the customs and practice of market and mill.

The greater part of round-edge lumber is manufactured by portable sawmills, usually operating with their woods crews as independent con-

tractors, either for the factories owning timber land or stumpage or for landowners and managers who are marketing their own lumber. The great bulk of the logs are cut in 12-foot lengths; but lengths of 10 and 8 feet are also used to utilize tops or for the most economical division of the tree. In pine, butt logs of good quality are frequently cut 14 feet, and in some localities, particularly the southern part of the region, 16 feet. Practically all pine timber is cut at least to 4 inches in the tops, and for some uses even as small as 2 inches. Stump heights are very generally kept nowadays below 6 inches, and on smooth lots, where the obstructions to sawing are few and the quality of the timber justifies the slight extra expense, root swellings are "boxed" or notched in with the axe and the trees sawed so as to leave stumps scarcely 3 inches high. For such cases some operators provide their choppers with cushions to kneel on, made of burlap bags stuffed with hay, and pay them an extra 10 cents a thousand for getting the lower stump. The saving of from 5 to 15 feet of the better quality of lumber usually found in the butt logs, if figured at the reasonable stumpage price of a cent a foot, will often add from one to three dollars a day to the money output of a felling crew.

In the case of pine, sound trees tall enough to make a single log are commonly cut to a breast-height diameter of 5 inches. Hardwoods are not commonly cut as small, 7 or 8 inches being a more common limit; but there are frequently slim, smooth trees of still smaller diameters, growing in thick stands, which yield one or two logs. An instance comes to mind of a gray birch, 7 inches d. b. h. and nearly 60 feet high and growing in dense pine, from which two 12-foot logs were cut, yielding about 40 feet board measure. In general, the diameter in the tops to which hardwoods are cut averages about 7 inches and fluctuates between 5 and 8, according to the character of the crown. Since every tree, regardless of species, that will make a sawlog is cut, and since a sawlog need only be large enough to yield a single board scaling from 2 to 5 feet, it can readily be understood that a portable-mill operation may take practically all material except small limbs and tops, not even excepting dead trees if sound, or heavy limbs, if, as the loggers say, they do not "crook two ways." In the occasional case where the limb wood can be sold as fuel, even the slash is very considerably reduced.

To the woods operator the great virtues of round-edge sawing are its high board-foot yield and the great economy of motion which it allows in the mill, where there is, as a rule, but one saw and where the manufacture of any more finished sorts of stock greatly multiplies the necessary motions. Logs sawed in this fashion are said to be sawed "alive" or "through and through"—that is, they are not turned down, as would be the case in

squaring up for dimension stock or square-edge lumber; but all the boards are taken off in the same plane and without being subsequently edged. Thus ordinary crooks or sweeps have little effect on the yield in board feet, since the log can be set on the carriage so that its crook comes in the plane of the saw. The boards are measured and marked on the narrow face. The marker or surveyor, guided at times by a board rule, but more often by his judgment alone, determines the average width inside the bark. This, in the case of a board from a normally smooth and straight log, will be the width at the middle; but with a board from near the outside of a crooked or very knotty log, it may be the average of the widths of several merchantable sections of the board separated by areas of wane where the bark runs clear across. Thus, in view of the comparatively large percentage of small and inferior timber made into round-edge lumber, the element of judgment involved in board measurement is very considerable. In mills of good standing, however, the marking or surveying is apt to be done with fair accuracy, because the contract payments for all of the woods operations are based on the mill measure, which in turn is usually required by contract to "hold out" or agree with the delivered or factory measure, which is the basis of sale.

It is commonly said by mill men that 1,200 feet of round-edge lumber is the equivalent of 1,000 feet of square-edge lumber sawed from the same run of logs. This relation seems to be fairly accurate, except that as the size of the logs increases the difference between round and square edge sawing becomes less and less and is practically negligible for diameters above 20 inches. With crooked, coarse, or defective logs of whatever diameter, the advantage is still more with round-edge sawing, owing to the disproportionate loss in "squaring up." But though round-edge lumber in general yields from 10 to 20 per cent more than square-edge, the amount in excess varies considerably with the manner of sawing and with the thickness of the lumber. Take, for example, the board-foot yield from sawing 2⅛-inch plank—a common thickness in the round-edge market. To begin with, according to the custom of the market, the eighth inch in this kind of stock is disregarded in measuring and is thus given to the buyer to cover shrinkage and planing. A 2⅛-inch plank sawed from a 12-foot log 6 inches in top diameter may show a difference of nearly 3 inches between the narrow and the wide faces. Such a plank with a measured face of 3 inches would contain 6 board feet. If the same plank had been sawed into two 1-inch boards, the yield would have been 8 board feet, represented by two faces, one of 3 and the other of 5 inches; and the saving of the disregarded eighth, balanced against the additional saw-kerf of one-quarter of an inch, would have left only three-eighths of

an inch more waste in sawdust. It is obvious that the smaller the logs the greater will be the loss due to this wane or difference between narrow and wide faces. On the other hand, as the size of the log increases, the difference in width between the two faces of the plank becomes less and less; and with logs over 16 inches in diameter, the loss in board-foot content and of the unmeasured eighth is more than offset by the saving in saw-kerf, to say nothing of greater economy of handling in the mill. In consequence of this shrinkage in yield for thick lumber, it has become the custom in fairness to the seller to take an inch siding or side-board off the log immediately after the slab, so that the first plank sawed will have its narrow and wide faces more nearly equal. These sidings are often somewhat of a drug and always bring from two to four dollars a thousand less than plank, but they effect a marked increase in the total board-foot output.

The influence of thickness—that is, amount of wane—on board measure, with the correlative factor of gain or loss in saw-kerf, is to be reckoned with in all round-edge lumber. In general, the highest yields for medium-sized logs are obtained from sawing 1¼-inch, 1½-inch, and 1¾-inch lumber, since these thicknesses allow a good face without excessive loss in sawdust and are, moreover, reckoned on a full board-measure basis. Complete studies of comparative yield from sawing different kinds of round-edge stock are not available; but the table given below exhibits some significant comparisons. It shows the differences in board-foot yield between three well-known log rules, all based on square-edge sawing, and the output actually obtained from the same sizes of logs when sawed to three different "saw-bills" or kinds of stock, two of which are entirely round edge and one mixed round and square edge. The figures for the round-edge lumber are taken from mill tallies made on the Harvard Forest, at Petersham, Massachusetts; those for the mixed lumber are from "Forest Mensuration of the White Pine in Massachusetts," published by the State Forester. In the case of the Harvard tables, the mill measure has been checked with that at the factory, where, according to the general custom, each board was remeasured on delivery without the figures in these cases being appreciably "cut" or raised.

Comparative yield of round-edge and square-edge sawing

Twelve-foot logs, board-foot contents

Top d. i. b.—inches	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Square-edge scale rules																
Doyle				3	6.8	12	19	27	37	48	61	75	91	108	127	147
Scribner				12	18	24	30	40	50	59	73	86	107	119	139	160
Maine				15	23	33	39	51	62	78	90	107	121	134	154	174

Mixed square and round edge scale rule																
[1] Pine (1, 1¼, 2⅛ inches)	13	17	22	29	37	47	58	70	83	96	111	129	146	165	184	
Round-edge scale rules																
[2] Pine (2⅛ in.) ...	3	8	14	21	30	39	49	61	73	87	101	117	135	157	181	208
[3] Chestnut (1½ in.)	8	12	16	22	32	42	53	67	83	101	119	137	157	176	197	218

From the point of view of utilization, the advantage of the round-edge sawing is not merely in the excess of yield for a given-sized log, but also in the fact that logs too small to be squared at all will yield merchantable lumber when sawed through and through.

The fundamental economy of round-edge sawing, and the even more important relation between quality and price, are to be learned only by a study of the utilization of the lumber at the factory. The ways of cutting up the board are as varied as the finished products. For each industry there are certain general properties required or desired of the lumber, both as to thickness, width, strength, grain, and degree of knottiness. In the making of match-blocks, for example, it is necessary to have pine that is straight-grained, reasonably tough and close-fibered, and wholly free from knots. Wood of this quality is obtainable, of course, from large forest-grown trees with a high percentage of clear wood. Such timber, however, is relatively scarce and usually more valuable for other uses. Match stock therefore usually means second-growth pine from 30 to 70 years old, in which the height growth has been sufficiently rapid to produce fairly long internodes of clear wood. Provided the annual growth has not been rapid enough to make the wood too brittle and provided the grain is straight, the size of the tree makes no difference.

The bulk of match stock, which is always sawed 2⅛ inches, is first planed to 2 inches. It then goes to the cut-up saw, where the block stock is taken out of it. This means pieces of any length, so long as the grain is right and the whorls of knots not too large or close together. The balance of the board, in certain standard lengths, goes through a resaw and becomes ⅞-inch box-shooks. These may be of any width, and even with tapering sides and after being edged and matched are glued together and trimmed so as to make one side of a standard box. Some box factories even have machines which get the tongue of the matched shook out of the edging, so that the waste from the box-shook making is all small and

[1] From mill-tally scale by Massachusetts State Forester; logs sawed into mixed round and square edge lumber; complete scale for all log lengths based on 1,200 logs; percentage of square edge "runs from nothing in the smallest logs to more than 50 per cent in the largest."

[2] From Harvard mill-tally scale; logs sawed into 2⅛-inch plank, with approximately 10 per cent 1-inch sidings; figures based on 511 logs.

[3] From Harvard mill-tally scale; logs sawed into 1½-inch round edge, with 20 per cent 1-inch boards, mostly sidings; figures based on 298 logs.

easily taken care of under the boilers. The block stock goes directly from the cut-up saw to the individual block saws without edging or trimming. At these saws all the clear stock is cut out in transverse blocks or sections 2 inches wide with the grain, and the bark or edging is trimmed off the sides of each individual block. The whorls of knots, which form a very small percentage of the selected board, drop through a chute and are conveyed to a shed for sale as kindling. Utilization like this, in which the final product is so small, and in the case of the box-shook, so allowably irregular in shape, is what makes the crooks, wane, and coarseness of the round-edge board have so little effect on the amount of usable material.

The sash and blind industry makes more exacting demands as to quality, but exhibits an equally close utilization. Nowadays most of the best stock used in this business comes from the West; but the second-growth pine still supplies the bulk of the material for all but the "number one" class of product. Sash and blind stock, which is usually sawed 1⅜ inches and 1⅝ inches, must yield a good percentage of clear or small knotted, straight-grained lumber in longer pieces than are required in many of the other pine-using industries. With the exception of genuine virgin pine, the only timber that will yield the desired qualities is either large second growth, with some percentage of clear in the butt logs, or with small and few knots, or else very rapid-grown "sapling" pine with internodes of 2 feet or more. In the sash and blind mill the man at the cut-up saw has a much more complicated job than in a match factory, for he has a much larger variety of pieces and qualities to cut for. Here, as in a match shop, the plank is separated into stock fit for the various sizes of frames, styles, muntings, and so forth, and into a lower grade of remnants which go into match-blocks, blind-slats, and the like. The cutting up of the sash stock is, however, not merely a matter of cutting out the whorls of knots, but also in wide lumber from fairly old trees of cutting narrow pieces lengthwise so as to pass between the knots. In a sash and blind factory, owing to the better quality of the lumber used and to the greater variety in the size of the manufactured piece, the waste is also practically nothing.

Other industries, such as the toy business, achieve an equally complete utilization with much cheaper and inferior lumber. Not only are there certain toys, such as hobby-horses, which can be made out of wormy and blue-stained pine largely consisting of knots, but there are many composed of parts as small as a man's little finger and of concealed sections, which can thus be made of the smallest and poorest waste. In fact, it may almost be said, taking into account all the possible industries to which round-edge lumber may go, that the only actual waste shipped from the sawmill is bark.

From the standpoint of the forest manager with timber to raise and sell, it is obvious that the high degree of utilization offered by the round-edge market is exceptionally favorable to intensive forestry. Yet the variable yields arising from the sawing of different thicknesses and the fact that definitions of grade appear but vaguely till the board is actually cut up in the factory add peculiar difficulties to the problem of marketing.

In general, the terms *box-boards, chair stock* (chestnut), *sash and blind stock,* etc., stand for certain average qualities of lumber; and in general, too, these qualities, if well understood by the seller, mainly govern the price of the lumber. But among the wide variety of industries making up the market, the qualities required for the making of different articles may differ widely, or overlap, or even coincide. Naturally each concern tries to buy the highest quality of lumber that it can without going above the prevailing price; and it very frequently happens that a company may buy on these terms a lot of lumber mill-run or a tract of stumpage which contains a very considerable amount of much better quality than their particular business requires. In such a case the better grade is usually saved out and sold to other companies for a higher price. From the cheapest class of pine lumber, such as is used, for example, by certain toy manufacturers, to the better qualities as exemplified by sash and blind stock, there is a range of price amounting on some markets to $15 a thousand; and between these two extremes there may be a number of other prices representing intermediate qualities as demanded by other industries. Moreover, to go back to the standing tree, this wide range of quality is only in small part dependent upon age, but even more upon composition, density, life history, and soil conditions, so that a given tract of timber may be convertible either into box boards alone, or box boards plus a good percentage of sash and blind stock, or into lumber of a quality standing somewhere between the two. In fact, theoretically, a given tract of timber may be separated into a considerable number of the recognized price classes of lumber. But the amount of the money return is not merely a question of maximum average price; it is also a matter of how much the board thickness required for a certain price is going to affect the total board measure for the sale. This means that round-edge lumber should be sold before the timber is cut. In fact, except by persons long and well connected in the business, it is folly to sell it otherwise.

In deciding a sale a number of facts must be known and considered with reference to each other. Take for a simple example a tract of second-growth pine which obviously contains nothing better than box boards. The available market may include three concerns—one using 2⅛ inches, another 1¼ inches, and another 1 inch. Supposing the price to be the same in all three cases, the choice for sale depends simply on a compari-

son of the board-foot yield for the three thicknesses and on comparison of hauling and freight rates—themselves somewhat affected by lumber thickness. Suppose, now, that the timber is largely or in part of qualities better than box boards. It is then not merely a question of board-foot output and freight rates, but also whether the timber as a whole will average good enough for a better price, or whether if the better quality is saved out for separate sale the price of the balance may not be too greatly lowered. Very often, especially for small tracts, it is better to market the whole lot mill-run and sawed to a single order for a medium price than it is to split the sale, saw to several orders, and get only a low price for the poorest, and often the most, of the lumber. In general, the larger the total amount of timber to be handled the better the opportunity for a classified sale to different markets and a consequent raising of the average price.

For the forester or operator of timber land, there should be another element in utilization besides the elimination of waste material. That element is financial economy. It should consist not only of efficient operation in the woods and sawmill, but also of lumber sales at maximum market rates. The utilization of the timber does not need much looking after: the buyers will take care of that: and when they buy twenty-eight-dollar lumber for the price of box boards, the seller will not discover it by any greater wastefulness in woods or mill. But the productiveness of the forest is not utilized, nor can it properly be gauged as a business possibility, unless the money return is the best which the existing market will allow.

Just as in the examples already discussed, there is a range of price-class in pine corresponding to qualities which, both in the woods and the factory, are recognizable if ill-defined, so are there with chestnut and with many species of hardwood. It is peculiarly the forester's business, if he would take advantage of the opportunities of the round-edge market, to understand not only the detailed uses and the prices of the lumber at the factories, so as to know the value of his timber in the woods, but also to trace the silvical factors which lie behind its production. It is not uncommon, for example, to find on the same soil and of the same age pine that will sell for $18 and pine that will sell for $28. In the so-called woodlot region, which, as the old timber is used up, is constantly widening in area, the portable mill and the round-edge board have already pushed material utilization to all but a maximum. Forest management has yet to adjust itself to this opportunity, first, by controlling more exactly the measurement and marketing of second-growth lumber, and, second, by growing timber that will improve upon the quality of the volunteer stands.

THE NATURAL ROOT GRAFTING OF CONIFERS

By Harold S. Newins,

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Nature has recorded many interesting facts in her forests. Some are observed by the forester in an empirical manner and applied without question to his practice. Others are investigated and the attempt is made to measure the factors which have caused them. Still others, however, are passed by, frequently unobserved. To the last group belongs the subject of this paper.

Natural root grafting of conifers is not necessarily an unusual occurrence. In many localities in the Douglas-fir forests of the Pacific Northwest one may find whole stands of trees with evidence that the roots beneath the soil are in many places firmly united. The natural root graft is a union of two or more roots. It may occur between the roots of one tree or of two or more trees.

The explanation of the origin of the graft is sometimes difficult. A theory which at first thought seems plausible is that the union is caused by the slight rubbing together of overlapping roots as the root systems respond to the tugging and pulling of their respective trees, which are swayed by the wind. Under these circumstances the rubbing would continue until the resulting friction had gradually worn away the cortex or outer covering of the roots at their points of contact. This would cause an abrasion, exposing the vascular tissues of each root and making possible the union of their cambium layers, thereby originating the graft.

However logical this theory may appear, it is not practical. Even though trees are swayed perceptibly by the wind, there is barely the least movement among the roots, which are held so securely in the soil. It is also observed that two trees of dissimilar species growing in close contact, and even crowding each other, do not entirely lose their respective barks at the point of contact, in spite of any possible friction. Illustrating this may be cited examples of Douglas fir (*Pseudotsuga taxifolia*). In one case this tree was found with the lower portion of its bole growing in direct contact with that of an Oregon ash (*Fraxinus oregona*). Ring counts on the cross-sections of these specimens show that the two trees have been resisting each other for twenty-two years, and yet each has its own bark almost intact. In another case a Douglas fir was found grow-

ing in similar contact with a Pacific post-oak (*Quercus garryana*). These two had resisted each other for at least sixteen years, and yet their respective barks are merely somewhat compressed at the point of contact.

Another theory which might seem plausible is that the two roots came into contact during their juvenile periods and, with the penetrating ability of the growing root, the one pierced its way through the other, initiating the graft. A glance at figure 3 and the discussion which follows will show that this apparently is not the case. It becomes evident,

FIGURE 1.—*a*, "Growing stump" of Douglas fir attached by root graft to the host tree, *b*; *c*, decadent fir stump; *d*, stump of Pacific post-oak

then, that the natural root graft owes its origin neither to friction alone nor to the penetrating ability of growing roots.

Many factors control the occurrence and frequency of these grafts, and their consideration here is essential before the correct conclusions as to the origin of the graft can be obtained. Some of these factors and their application may be grouped as follows:

A. *Vitality of the Trees*

The natural root graft is initiated only between living trees. The roots of a dead stump have no ability to become grafted to the roots of a living

tree. When stumps are found attached by root graft to a living tree, the explanation is that the graft was initiated before the felling of the tree that caused the stump (see figure 1).

B. *Character of Stand, Whether Pure or Mixed*

The natural grafting of roots is found between trees of similar species only. For this reason the occurrence is more frequent in pure stands than in mixed. Illustrating this may be cited an incident concerning two

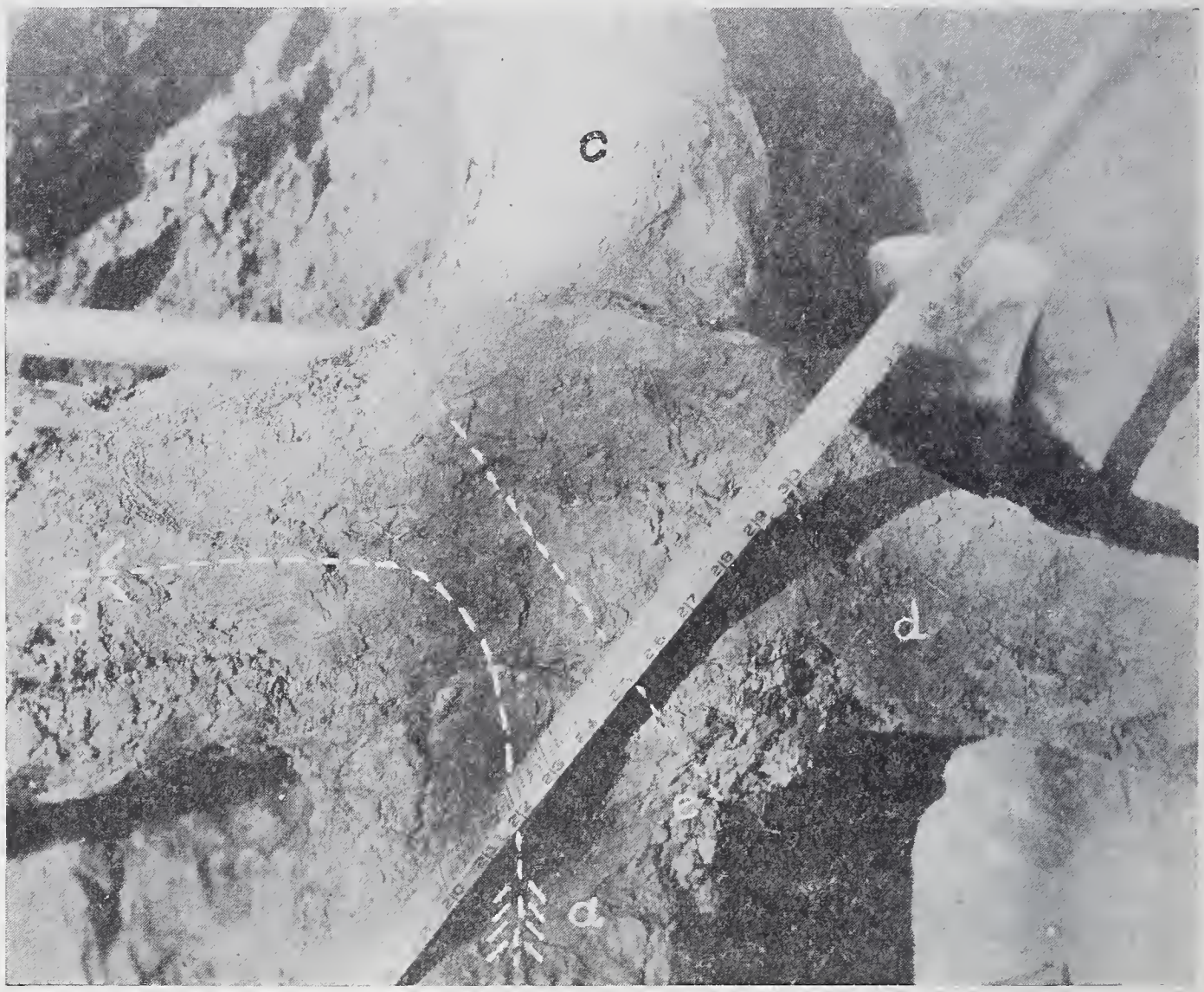

FIGURE 2.—A close view of the graft connecting the growing stump to the host tree (figure 1). Arrow *a b* indicates the course of food materials from the host tree to the "growing stump"; *c* and *d*, dwarfed portions of the roots; *e f*, line indicating the section from which figure 3 is taken.

coniferous species of different genera which were found growing in close proximity, but not uniting their roots. A grand fir (*Abies grandis*) 60 years old and 14 inches in diameter was found growing in such close contact with a Douglas fir 4 feet in diameter and 200 years old that when the latter was cut down the grand fir soon toppled over for lack of support. The root system which was thus entirely exposed exhibited no union with the root system of the fir.

C. *Density of Stocking*

Trees growing in close association produce many interlacing roots and thus increase the possibility of a union. It is noted, however, that very

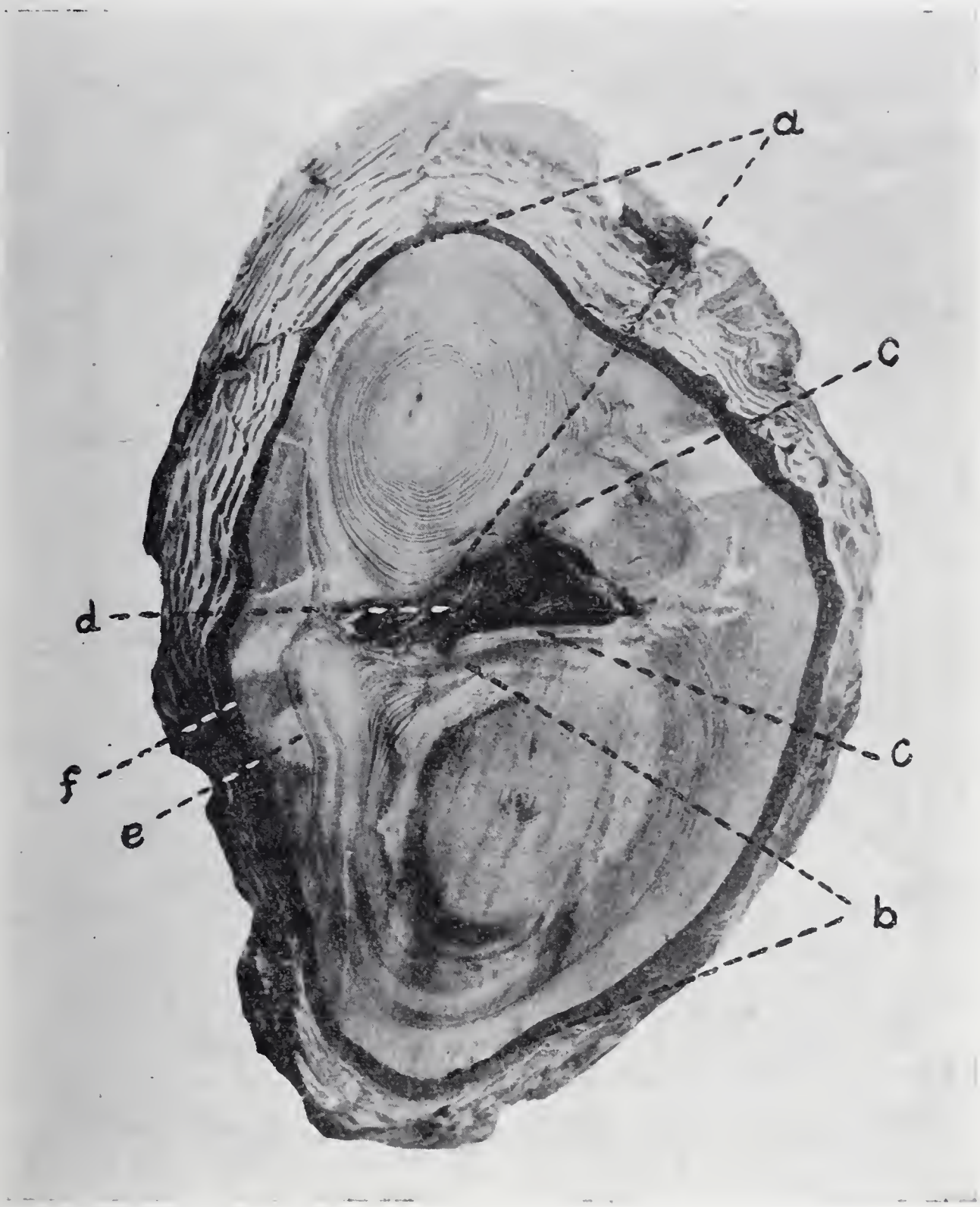

FIGURE 3.—A cross-section of the graft taken along the line *e f* of figure 2; *a*, cross-section of root of "growing stump"; *b*, section of root of host tree; *c*, included bark; *d*, included soil; *e f*, growth of wood encircling the two roots.

often the larger roots are the ones to become grafted. Hence trees may stand somewhat isolated from each other and still be connected by their wide-spreading lateral roots.

D. *Character of Root System*

Trees with wide-spreading and superficial lateral roots are more liable to unite in root grafting than are those with deeply penetrating roots that have few laterals. For this reason the conifers, with their widely spreading root systems, are very liable to root graft.

E. *Age of Trees*

Natural root grafts are more liable to occur during the youth of the trees, and their evidence is particularly noticeable in even-aged stands.

The origin of the root graft is accounted for by the pressure exerted from the opposing roots of a similar species (see figures 2 and 3). As the roots continue to expand, the pressure becomes greater and gradually forces away the cortex at the two outside edges of contact (see figure 3, *a b*). This exposes the cambium layers at these points, and because there exists an affinity between them their union follows and the graft is initiated. The removal of the cortex at the place of union is assisted by the presence of resin, common to coniferous species, which is forced by the prevailing pressure through any possible rupture in the cortex and helps in wearing away the bark. When the union has become complete and the two roots grow as one, the pressure is relieved between those portions which were previously the opposing surfaces and any bark which may be inclosed (see figure 3, *c*) then ceases to function. This, together with any adjacent soil (see figure 3, *d*) or debris, becomes occluded by the wood of the united roots.

The results of root grafting are of peculiar significance to the forest pathologist. When two trees become united by contact beneath the soil, the effects of any disease or injuries inflicted upon the one become then the property of the other. Thus one tree suffering from *Trametes pini* may transmit through its roots the effects of this disease, if not the disease itself. *Trametes pini* is known to be carried from one tree to another through natural root grafting, although this is not considered a very important means of transmission.[1]

In a similar manner one tree may bestow benefits upon another. Should one be injured, there is a reciprocal action between the two in healing the injured portion. This is true to such an extent that one of the two trees may be broken off or cut near the ground, leaving only a stub or a stump, and yet the vitality of the healthy tree will extend through the grafted roots and heal the wound in much the same manner in which it would heal its own injuries. The result of such conjunctive symbiosis is a

[1] R. S. Hole. "*Trametes pini* in India," Indian Forest Record, 5 (1914), No. 5, pp. 159-184 (tree referred to is *Pinus excelsus*).

"growing stump." These "growing stumps" are curious objects of nature, and because the solution for their origin is concealed beneath the soil the mystery has caused much speculation. In some cases they may be found growing vigorously and yet be isolated as far as 20 feet from any living tree (see figure 1). When found so isolated, the common belief has been that they subsist by drawing on a reserve supply of food materials which have been stored within their bodies and roots. A common opinion among some farmers is that "growing stumps" are an index to extremely rich soil. This belief can be attributed to the fact that when forested agricultural land is first cleared of timber there often is left standing a veteran stump, which of course is surrounded by a number of stumps. Should one of these stumps have been grafted by root to the veteran tree, it will develop into a "growing stump." Hence the erroneous index of fertility. The farmer speaks of such land as containing "living soil."

The manner in which the exposed surface of the stump of a root-grafted tree is healed and becomes finally occluded with growth is very interesting. It is identical with the way in which trees heal their wounds. In the case of the "grafted stump," the injured portion is adopted and nursed by the host tree. The stimulus for healing comes from this tree in conjunction with the stump's root system, which, by the way, remains intact. These cause an acceleration to the local functions and at the same time send proteid solutions flowing to the wound. The result is at least a temporary increase in vitality and resistance to external factors. During this stage the wound must be protected from any micro-organisms of decay and the loss of food substances prevented. Nature accomplishes this by impregnating the injured portion with a resinous material. The process by which this is done has been described in recent popular literature as follows:

"In the linear ducts of the tree [for our purposes the stump] vesicles or droplets begin to form—the result of a stimulated cell-making, consequent on injury. The cells of the walls of the duct take part in this and the result is the checking of the flow of sap. This prevents bleeding or the loss of tree liquids. This cicatrizing substance is particularly to be found in the longitudinal ducts of plants and has been closely studied by Mangin and other botanists. It forms in droplets on the inner walls of the broken canals, growing little by little and finally establishing the complete closure of the duct." [2]

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[2] "How Trees Heal Their Wounds," from La Nature and copied in Illust. Sci. American, S. 81: 53, Jan. 22, '16, and Lit. Digest, 52: 433, Feb. 19, '16.

During this treatment the cambial cells become active and produce the healing tissue or "callus," which appears as a ringlike outgrowth on the peripheral edges of the stump's cut surface, and, spreading gradually, this circular crest meets in the center. Here the margins fuse and the stump becomes capped. In the meanwhile the callus has developed further and produced an external protecting layer of cork. This is easily accomplished by impregnating the cell wall with suberine, and following this the cell contents disappear and their place is taken by air. The injury is then healed; normal cambial activity produces bast cells, which form new bark, and xylem cells, which form new wood.

It is interesting to note that the stumps of root-grafted trees of some species cover their injuries with new growth more frequently and more rapidly than do others. "Growing stumps" are so common in some second-growth stands of Douglas fir in Oregon that the writer, with a small field glass, has found and studied as many as 30 specimens during a two-hour absence from the class-room. The rapidity with which the Douglas fir will heal its injury is particularly noticeable. An appreciable amount of callus is produced during the first few growing seasons that the injury on the stump is exposed. This callus is distributed unevenly about the border of the stump cross-section, with the greatest amount on that portion nearest the grafted root. As this process continues and the callus advances over the cross-section, there remains at the last stages a small surface of the stump still exposed which is surrounded on all sides by the approaching callus. The result is a cup-shaped receptacle which holds water and catches debris, sometimes making decay possible, in spite of Nature's first-aid protection. Gradually this surface becomes covered and the entire portion is occluded with new growth; then the injury is healed, new wood is formed, and the stump increases in size and actually "grows." A single example of a "growing stump" of western yellow pine (*Pinus ponderosa*) was observed by the writer. This became heavily saturated with resin shortly after cutting and was slow to respond with the usual outgrowth of callus. The grand fir seems to be fully as active as the Douglas fir in this regard, although the occurrence appears to be less frequent (see figure 6). All of these species exhibit odd spectacles in the forest when the grafted specimen is a stub which has become broken off at the top by the action of wind or some other external agency other than the axe or saw of man. The "growing stub" has many irregular surfaces and is heavily coated with callus.

"Growing stumps" of Douglas fir have been found that are of a remarkable old age. "In the forestry building at Portland, Oregon, is an excellent example of one of these occluded stumps, which for museum

purposes has been ripped lengthwise. A count of the rings of callus show that there are more than 200. This indicates that this root parasiticism makes it possible for the stump or stub to function for a great number of years." [3]

The basis of proof for the material submitted in this paper may be found by reference to the illustrations. These have been photographed in the vicinity of Corvallis, Oregon, and in connection with the writer's field work in silvics.

Figure 1 shows many interesting facts. In the center, *a*, is a "growing stump." To the right, *b*, at a distance of 20 feet from the stump, is the host tree to which the former is attached by root graft. The graft is located midway between the two and is buried 2 feet below the surface of the soil. At the left, *c*, is a decadent stump which was not fortunate enough to have been attached to the roots of the living tree. These specimens are all of Douglas fir. At the extreme left, *d*, is a stump of Pacific post-oak which, together with the decadent stump, is seen to better advantage in figure 5. The oak stump is of value to the discussion in that it has recorded the age of the dead fir stump.

Figure 2 is a view looking down upon the exposed graft, *in situ*, with the soil removed. The curved arrow, *a b*, indicates the course of food materials from the host tree to the "growing stump." The line *e f* indicates the section from which figure 3 is taken. Note the dwarfed condition of the less active portions of the roots at *c* and *d*. That of the tree, *c*, is 5 inches in diameter, while that of the stump, *d*, is but 3½ inches. Compare these with the more active portions, *a* and *b*, which are 7 inches in diameter where they join the graft.

Figure 3 illustrates a cross-section along the line *e f* of the graft seen in figure 2. This figure shows, *a*, a cross-section of the stump root containing a total of 100 annular rings; *b*, the cross-section of the host tree's root, which contains a total of 146 rings; *c*, the respective barks of these roots at the points of contact. These, together with the included soil, *d*, are entirely occluded by annular layers of wood, *e f*. A study of the figure reveals the history of the graft. When the two roots first came into contact, the host tree was about 50 years old and the stump about 30. Their union was completed approximately 15 years later. At the right may be seen the cross-section of a small root which, becoming encircled by the growth of the two larger roots, joined their graft.

Figure 4 shows the "growing stump," *a*, with one-half of the upper portion of its covered surface removed. The transverse section is made

[3] Munger, T. T. Memorandum Regarding Douglas-fir Stubs and Stumps that "Grow" after the Upper Portion of the Tree has been Broken or Cut Off. Unpublished.

2 feet above the ground and gives the ring counts, which determine the history of the stump. The reader can best follow the relative positions of the subjects under discussion by reference to the longitudinal section, *b c d*. The original stump, *e f*, contains 66 rings and is surrounded by 60 distinct rings of occluded growth, *g*. This indicates that the tree was felled 60 years ago and at that time was about 70 years of age (allowing 4 years for the 2 feet of elevation at which the section is made). The

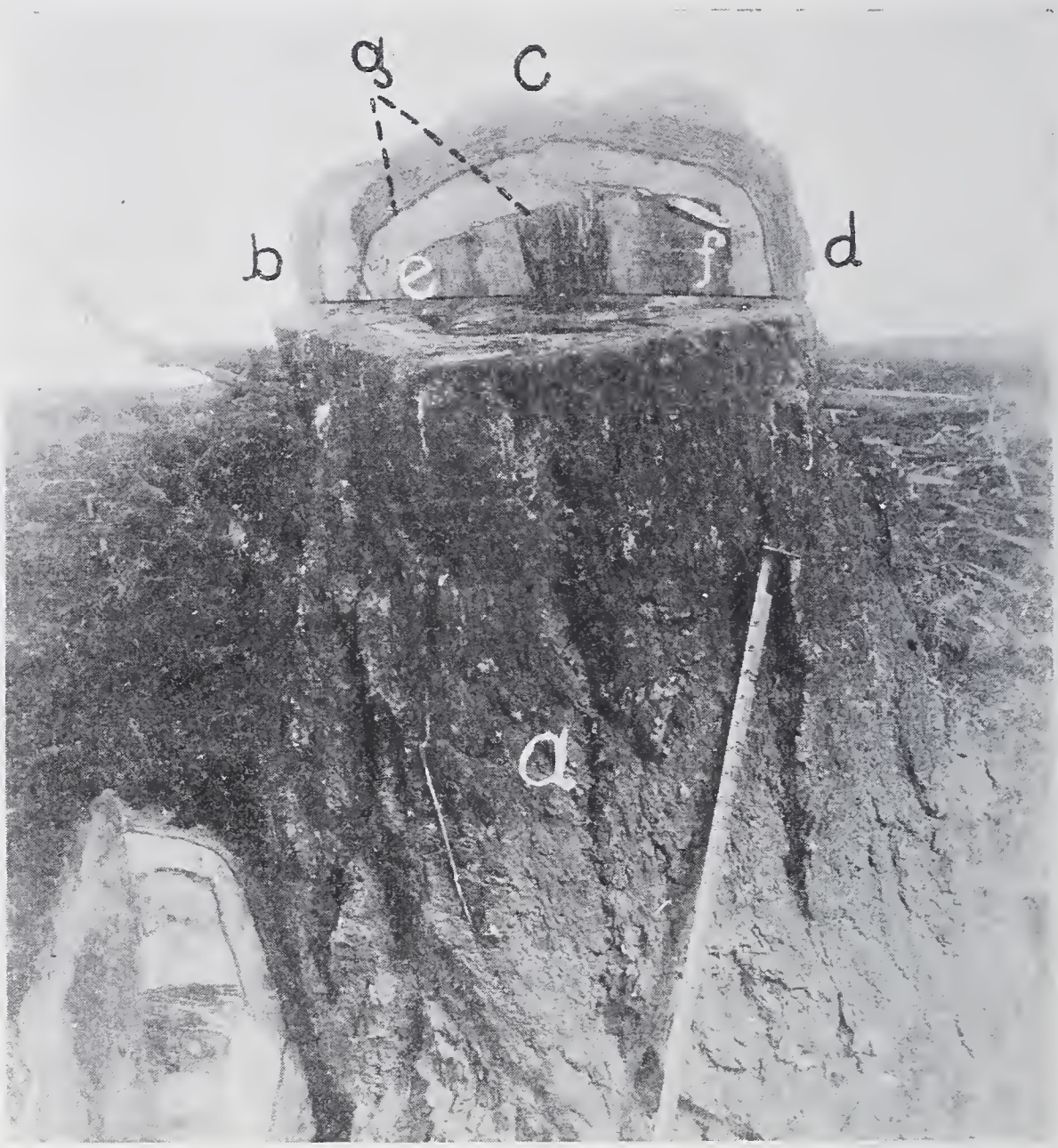

FIGURE 4.—Closer view of the growing stump, *a*, seen in figure 1; *b c d*, longitudinal section showing the original stump, *e f*, which is now covered with the occluded growth, *g*.

knife is inserted to show the dividing line between the original stump and the overlapping growth. This section shows also the sloping effects of the original stump cut, which no doubt aided in the preservative properties of the wood by tending to shed water and debris from its surface.

Figure 5 shows the stumps of Douglas fir, *c*, and Pacific post-oak, *d*, seen at the left in figure 1. The oak stump is of recent origin, and the

period which has elapsed since it was cut can easily be ascertained by determining the age of the sprouts, *b*, protruding from its base. These indicate a period of one year. The stump is 18 inches high and has 51 rings on the transverse section. The age might be safely approximated at between 55 and 60 years. It is logical that the oak started as a seedling shortly after the removal of the upper portion of the Douglas fir, which previously occupied the same site. Then the decadent fir stump, *c*, must have been cut at least 55 years ago, and we may safely surmise

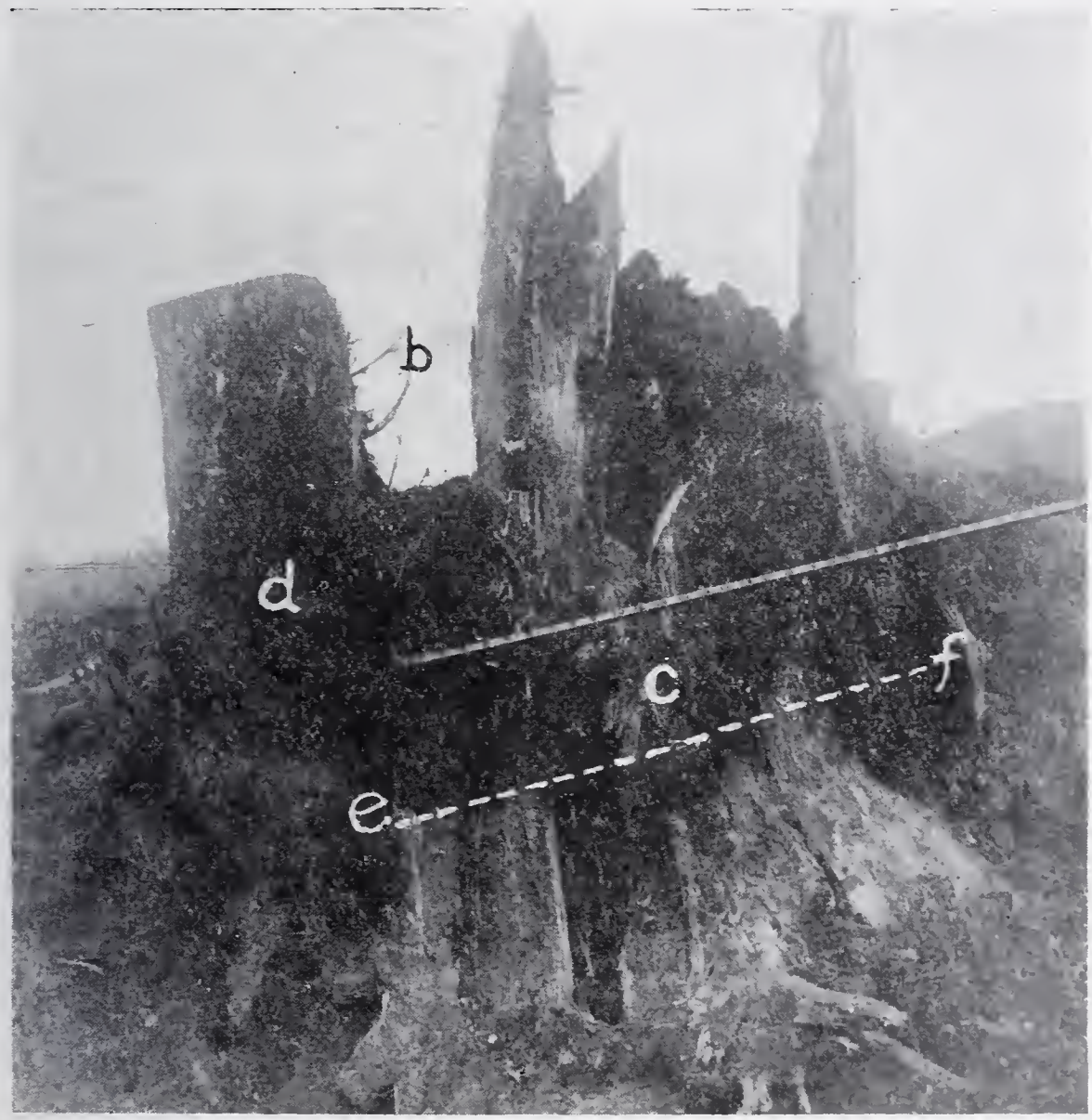

FIGURE 5.—Close view of decadent fir stump, *c*, and Pacific post-oak, *d*, seen in figure 1; *b*, twigs indicating age at which oak stump was cut; *e f*, line from bark to bark indicating original stump.

that the period was 60 years. Thus Nature has given us the history of these two Douglas-fir stumps (figure 1, *a* and *c*). The trees were cut from both in approximately the same year. As a result of root parasiticism, the one has survived 60 years of good health; the other, although only 8 feet farther away, was not so fortunate. This stump, however, contributes a record showing the rapidity with which Douglas fir will decay when deprived of life and left to the destructive agencies of the

elements. A measure from bark to bark, *e f*, of this specimen shows the original stump to have been 2 feet and 4 inches in diameter at the base. It is now barely 1½ feet and almost completely decayed.

Figure 6 shows a "growing stump" of grand fir nearly 3 feet in diameter and located but about 2 feet from the host tree.

These data lead to the following conclusions:

1. The natural root grafting of conifers is common only between trees

FIGURE 6.—"Growing stump" of grand fir nearly 3 feet in diameter and located about 2 feet from the host tree

having an affinity for each other and is due moreover to pressure exerted by two or more opposing roots in combination with a number of physical factors.

2. "Growing stumps" and "growing stubs" are the result of conjunctive symbiosis, which is made possible by their natural root graft with a living tree.

3. The phenomenon of the "growing stump" is observed among conifers and is most common with Douglas fir.

SLASH PINE—AN IMPORTANT SECOND-GROWTH TREE

By Wilbur R. Mattoon,
Branch of Research, U. S. Forest Service

Slash pine (*Pinus caribæa* Morelet) is fast replacing longleaf pine over portions of the coastal plain of the South as loblolly is doing in the northern part. Intrinsically it is a better tree than longleaf. Its growth is more rapid, its wood heavier, harder, and stronger, and its yield of turpentine larger and of a better grade. The chief causes for its spread are clearly its frequent and abundant seed production, very rapid growth, tolerance, ability to withstand the combination of hogs and fire, and capacity to adapt itself to a wide range of environment. It appears to have in a high degree the necessary qualifications for being handled on a large scale under approved methods of silviculture. It is generally recognized that, in addition to local agricultural development, the future resources of the southern coastal plain, at least for half a century, lie chiefly in the production of timber, and especially naval stores, on its millions of acres of flat, poorly drained, sandy soils. Although relatively little known, slash pine is contributing an important share in the economic products of the region, and will continue in the future to do so to an increasing extent.

An unfortunate confusion of nomenclature in the past accounts in part for the little that is known regarding slash pine. This is the tree called *Pinus cubensis* Sargent in the U. S. Tenth Census Report,[1] *Pinus elliotti* Engelmann in the writings of Dr. Engelmann, and Cuban pine, *Pinus heterophylla* (Ell.) Sudworth, in former publications of the Forest Service. The name used in this article seems likely to become permanent, since it is recognized by Dr. Sargent, Dr. Britton, Dr. Shaw, and as the official name by the Federal Forest Service. Dr. Harper and Dr. Small still refer to the tree as *Pinus elliotti* Engelmann, recognizing it as a distinct species from *Pinus caribæa*. Its obscurity is also accounted for by the fact that in its younger stages it is quite generally known as "old field" or "shortleaf" pine, and thus often mistaken for one of several other species, chiefly loblolly, which it resembles both in form when young and in the wide annual rings of growth when the wood is cut into lumber. In its maturer stages the untrained observer finds some difficulty in distinguishing slash from loblolly, on the one hand, and from longleaf, on the other. It appears certain that rather frequently slash

[1] Report by Dr. C. A. Sargent.

pine has been incorrectly reported as loblolly from southern Georgia and Florida. Fortunately the species in its maturer stages locally is pretty well known throughout its range as "slash" or "yellow slash," and only occasionally as "bastard" or "meadow" pine.

PRESENT RANGE OF DISTRIBUTION

Its range of distribution extends from southern South Carolina westward to near the Mississippi River in Louisiana,[2] and from the southern

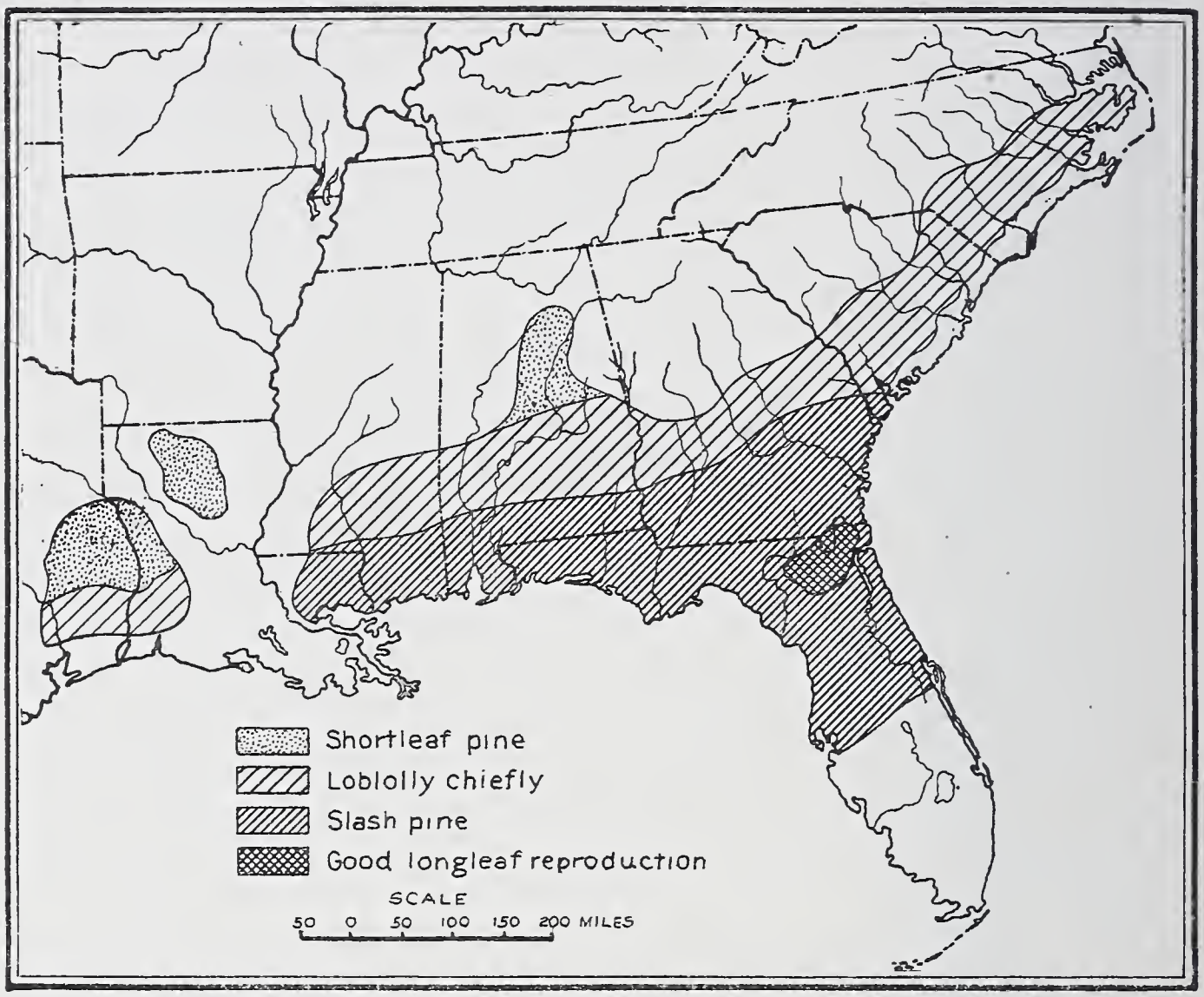

FIG. 1.—*Former longleaf-pine lands and the various pines which are establishing themselves as the chief second growth*

limit of the Florida peninsula northward to points about 50 miles inland in Mississippi, 75 in Alabama and South Carolina, and 130 to 150 miles in Georgia.[3] It is the only pine in the south half of the Florida peninsula, also on the Bahama Islands, and is found in the West Indies, Hon-

[2] In April, 1916, found by the writer growing vigorously as far west in Louisiana as Hammond, Tangipahoa Parish. The Pearl River, either in Mississippi or Louisiana, formerly has been considered its western limit. See "Manual of Trees of North America," by Dr. Sargent, and article by Dr. Harper on page 330 of the Proceedings for July, 1916.

[3] Harper, Dr. R. M. Range map in "Southern Woodlands," Feb., 1908, p. 29.

duras, and Guatemala.[4] Its range in the United States covers about 35 per cent of the total longleaf-pine belt.

It is most interesting to compare the present known range in South Carolina and Georgia with that of 1880 as given by the best authority, Dr. Mellichamp, as quoted by Engelmann:

"From South Carolina, on the sea islands, near Charleston to Georgia along the coast, and sparingly as far as 15 to 20 miles inland, but never very far from the influence of salt water."[5]

The discrepancy is undoubtedly due partly to incomplete information at the time and perhaps more to the rapid spread of slash pine in the second-growth forest over former longleaf-pine lands.

FACTORS OF LOCAL DISTRIBUTION

The northern limit of slash pine is undoubtedly determined rather by temperature than moisture conditions. The isotherm marking the mean annual minimum (extreme) temperatures of 20° F. roughly coincides with the present northern limit of the species. The absolute minimum along this line averages about 5°.[6]

The average dates of the first and last killing frosts are November 15 and March 1. The mean maximum temperature for July along this line falls at about 90°. Fortunately there is record that the species withstood without injury the unprecedented "freeze" and spell of snow and ice of late January and early February, 1895, when nearly all orange groves in the South were destroyed. Not even the unfolding flowers were impaired.[7] The region of best development, so far as known, is that having a mean annual rainfall of 50 to 55 inches. In south Carolina slash extends into the belt of about 45 inches and in Mississippi and Louisiana 60 inches of rainfall. The precipitation occurs in about 100 to 125 days.

The species originally was characteristically one of the moderately wet, flat lands bordering swamps and bodies of fresh water on the newest or Oligocene soils of the coastal plains.[8] It now occurs widely on light, sandy soils underlain with loamy or clay subsoil and retentive of moisture. On the wire grass and palmetto flats, composed of fine compact sand underlain by hardpan and very poorly drained, it is often the only

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[4] Shaw, Geo. R. Arnold Arboretum Publication No. 4, "The Genus Pinus."

[5] "Revision of the Genus Pinus." Transaction of the St. Louis Academy of Science, Vol. 4.

[6] In southern Alabama the range of slash goes a little north of the 0° isothermal line.

[7] Mohr, Dr. Chas. Forest Service Bulletin 13, "Timber Pines of the Southern States," p. 88.

[8] Harper, Dr. R. M. "Southern Woodlands," Feb., 1908, p. 28 (under name of *P. elliotti*).

second-growth pine. It avoids altogether the very dry, deep sands of the "pine barren" hills, such as parts of western Florida and southern Mississippi, but locally is abundant close to lakes, streams, and in ponds. This is perhaps due to a decreased ability of the seed to germinate successfully and also the intensity of fires during the seedling stage on dry soils as compared with the moisture and slow fires on the low, flat lands. It is characteristically the pine of the deep, coarse, sandy soils along the coastal margins, including dunes and reefs.

It reaches its best development on well-drained, upland, sandy, or loamy soils underlain with clay, in which it finds good moisture conditions. Extensive areas of this type of land occur from the Savannah River basin, across southern Georgia to the Okefinokee Swamp, and the St. Marys and Suwanee rivers in Florida. In western Florida and southern Alabama and Mississippi, over the low, gently rolling country, slash is the complementary species with longleaf, the latter covering the "ridges," or surface convexities, and slash the concavities, or surface depressions.

The moisture and soil requirements of the seed for successful germination have not been sufficiently studied to warrant definite conclusions. The slower spread of slash pine over the dryer, sandy soils, for example, may be due to requirements of the seed for germination or to later fires, which here run with greater severity than on the lower flat lands. This subject offers an excellent field for investigation. As regards soil, although very much slash pine occurs on wet, muck soils of ponds and "dry" swamps, and is known to germinate vigorously in broom sedge (*Andropogon* sp.?) and wire grass (*Aristida* sp.?), even when left "rough" for several years, it occurs widely over rolling, sandy lands, and many almost perfect stands are found in abandoned fields of nearly pure sand on upland situations. This indicates the marked adaptation of the species to a wide variety of environment.

In regard to fire, the successful establishment of slash pine requires early protection from hot ground fires for a period of from two to three years. Attaining a height of 8 to 16 inches the first year, the species continues growing at a remarkably rapid rate, reaching from about 3 to 5 feet the third year. In the same period the associated longleaf pine makes most of its growth underground, developing a very stout taproot and a stem of some 1 to 3 inches in height surrounded by a mass of protective green leaves. The continued slow upward growth of longleaf, however, keeps it battling with fire for a period of six to ten years, whereas with a succession of two or three years following germination, with no fires hotter than a light surface burning, slash pine is able to reach a point well above serious injury from all ordinary fires.

IMPORTANT SILVICULTURAL CHARACTERISTICS

Silviculturally the species possesses a number of desirable qualities.

1. Growth is rapid. This may be illustrated by the heights of seedlings found growing near Watertown, Florida, on June 2, 1916. Thirty seedlings pulled at random at dusk averaged from about 10 to 12 inches and one measured 17 inches. Germination had occurred in late fall or early winter, so that about half of the first season was left for further development. In rate of growth this undoubtedly exceeds that of all other North American conifers, with cypress and loblolly pine holding secondary places. On well-drained, low, sandy soils with clay subsoil slash pine averages about 5 inches in diameter and 30 to 35 feet in height at 10 years old. Individual stands are found considerably taller. In one 17-year-old stand of medium open density, on deep sandy soil and *protected from fire,* the trees of all classes averaged 60 feet in height and 11 inches in diameter breast high. It is known that growth continues at a rapid rate for several decades, but additional studies are necessary in order to obtain desired information on this subject.

Table 1, based upon obviously inadequate data and therefore preliminary in character, is the first of its kind to be prepared for slash pine.[1] It undoubtedly indicates fairly well the characteristics of development of the species in second-growth stands of good density, and affords an opportunity for tentative comparison with growth tables for other pines.

TABLE 1.—*Growth of slash pine in well-stocked stands.*

Age.	Diameter (breasthigh).[a]			Height.[b]		
	Max.	Average.	Min.	Max.	Average.	Min.
Years.	*Inches.*	*Inches.*	*Inches.*	*Feet.*	*Feet.*	*Feet.*
5	2.3	1.5	.8	14	10	6
10	5.2	3.7	2.4	33	23	13
15	7.5	5.1	3.5	51	36	21
20	9.4	6.5	4.4	61	46	31
25	11.0	7.8	5.2	68	54	40
30	12.3	8.8	5.8	73	60	46
35	13.4	9.7	6.4	77	64	51
40	14.4	10.5	7.0	80	68	55
45	15.2	11.3	7.6	83	71	58
50	16.0	12.0	8.1	86	74	61

[1] Studies of individual development under various conditions were made by Dr. Mohr.

a Decade measurements on 14. 0.3-5.0 foot stump of average sample trees 11–119 years old.

b Based on sectional age counts of 18 trees; also average height of 19 sample plots (71 trees) and total height average of 9 trees.

Development is slowest in the flats or ponds where the roots are submersed in water for considerable of the year. In southern Florida it is understood that this is true over a very large area; also near the brackish tidal water of the numerous bayous of the coast. The key to the extensive occurrence of slash there seems to be the splendid germination of its seed resulting from sufficient moisture in the fall or dry season, when its seed germinates; also the protection afforded from fires. Growth is most vigorous in the clayey loam soils of medium uplands, with good drainage and good moisture supply.

2. Slash pine is clearly the most tolerant of the four southern commercial pines. It cleans itself quickly, makes a clear, symmetrical trunk with short crown, even in the open, and characteristically grows in dense stands. In this respect it exceeds somewhat both shortleaf and loblolly, and contrasts in striking manner with the intolerant longleaf. Its ability to thrive under partial shade, combined with a rapid rate of growth, accounts partly for its gaining the upper hand over the light-requiring longleaf on all except the very dry, sandy soils.

3. Seed is produced at frequent intervals and in considerable quantity. Engelmann says that in South Carolina the species "produces seed abundantly every year, different from *Pinus australis* (longleaf)." [9] It seems doubtful whether this statement is intended to apply to every tree, but it is quite certain that within the stand some seed is produced practically every year. The seed is medium sized for pine and is readily borne by the wind for distances of several hundred feet; as a result its young growth is known commonly as "old-field" pine. Seed is borne by slash very early in life. Well-developed cones were observed as abundant in central southern Georgia on trees 14 years old, and thrifty stands 18 years and over yielded seed abundantly. In Baker County, Florida, some thrifty 10-year-old trees standing open were seen with from 8 to 12 normal cones. The flowers appear and pollination takes place from two to four weeks earlier in the spring; also the seeds mature earlier than those of any other pine,[9] and they germinate soon after falling from the cone. In southeast Georgia the writer observed an abundant seed germination about complete on November 4, 1913. This early start gives the seedling a marked advantage over most other forms of competing growth.

4. In regard to the adaptability of slash pine for artificial sowing and planting, little can be said based upon experience. The fact that it reproduces in abundance and grows vigorously within its natural range affords an indication of its possibilities. Observations point to the de-

[9] Engelmann, Dr. George. "The Genus Pinus." Transactions of the St. Louis Academy of Science, Vol. IV, 1880.

sirably of good soil preparation on medium uplands, similar to experience with maritime pine on the Florida National Forest. The results of an experiment carried on under the most trying conditions will serve to indicate the hardiness of the species. On June 2, 1916, 40 forest seedlings were dug near Lake City, Florida, and shipped by parcel post to Summerville, South Carolina, where they were set out. Twenty were one-half year old and twenty were one and one-half years, having germinated in the late fall of successive years. In spite of the more than two days' journey on the road in the hottest season and injury to the plantation by chickens, the results on the following June 24 showed 41 per cent of the older and 55 per cent of the younger trees alive, all but about four of these in thrifty condition.

ADVANCE OVER FORMER LONGLEAF PINE LANDS

In its spread over lands formerly occupied by longleaf, slash pine is the dominating species in the young second-growth pine extensively over southern Georgia, over the flat lands of southern Alabama, Mississippi, and southeast Louisiana, and portions of Florida.

In going west from Savannah, Georgia, along the Seaboard Airline Railroad, over a country very largely cleaned of its virgin forest, the only longleaf reproduction one will see for toward a hundred miles consists of here and there an occasional very uneven stand of saplings and small poles on a dry, sandy ridge, a half dozen or so old-field stands dating from about the Civil War, and many scattered small groups battling for their existence against the fires. A little loblolly is seen just out of Savannah, and afterward only on the alluvial bottoms of the larger rivers and their tributaries. Here, also, is some spruce pine (*Pinus glabra*). Pond pine and cypress occur in ponds and on particularly flat surfaces of acid soils. Along the entire distance, however, of 160 miles to Cordele, Georgia, much young pine up to 15 to 25 years is seen in irregular abundance, between 80 and 90 per cent of which is slash pine. It occurs in broken and irregular stands, innumerable scattered groups and small stands, in abandoned fields and unused corners about the farm, and along the fence rows, railroad cuts, and embankments. It is most abundant and of largest total area for the first 60 to 90 miles over the flat lands and low uplands, but continues westward with increasing altitude into the better-drained hilly lands. The present situation in some respects is parallel to an early one with loblolly farther north, the Savannah River being about the dividing line. The border line between the two species is generally well defined. It is perhaps well to mention briefly the fact

that within the slash-pine zone loblolly pine is a tree characteristically confined to alluvial bottoms. With the possible exception of the hilly region about Tallahassee, Florida, and a narrow strip along the Georgia coast, it reaches relatively very little importance as a commercial timber tree. This condition will no doubt be a surprise to a good many who have mistaken slash for loblolly pine.

The innumerable ponds which dot the southern coastal plain have become noticeably drier since the removal of the protective virgin pine forests. As a result pond cypress and black gum, their chief former inhabitants, are being replaced extensively by the invasion of slash pine, which formerly found its habitat around the margins. Artificial drainage would have the same effect, but this change has occurred extensively in regions distant from such drainage, due wholly to cutting the forest.

As long ago as 1880 Engelmann states that "Professor Sargent observes that while the longleaf pine rapidly disappears under the axe, Elliott's (slash) pine becomes more and more common." [11] Later Sargent says that "in the coast region of the Southern States (slash pine is) gradually replacing the long-leaved pine." [12] Mohr, in his exhaustive work on the southern pines, found that "the Cuban (slash) pine is gaining the upper hand over the offspring of the light-requiring longleaf pine, which, on the damp soil of the coastal plain, is soon outstripped and finally almost completely suppressed by the seedlings of this tree." [13]

In explanation of the spreading power of slash pine, certain inherent characteristics easily account for its behavior. The key to the situation lies in the presence of slash-pine seed trees left from past loggings along streams and over low grounds. Its spreading power is easily accounted for by the tree's production, in abundance and at an early age, of seed capable of traveling long distances by the wind, the immunity of this seed from hogs, its quick germination, and the rapid development of the seedling, early taking it beyond danger from ordinary ground fires.

COMMERCIAL PRODUCT AND BY-PRODUCT OF THE TREE

The heaviest, hardest, and strongest coniferous wood grown in the United States is that of slash pine.[14] This and the fact that the tree yields as a by-product a larger amount and a higher grade of crude tur-

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[11] "Revision of the Genus Pinus." Transactions of the St. Louis Academy of Science, Vol. IV, 1880.

[12] "A Manual of the Trees of North America," p. 19, 1905.

[13] "The Timber Pines of the Southern States." Forest Service Bulletin 13, p. 88.

[14] Forest Products Laboratory, Madison, Wisconsin, based upon tests of small, clear specimens, 2 by 2 inches in cross-section; bending 28 inches span.

pentine than longleaf, and possibly any other species of pines, make the tree one of high economic value.

The wood is characterized by relatively very wide bands of summer wood, sharply defined from the spring wood. Its specific gravity, averaging .677, is exceeded among important commercial woods only by the hickories and the heavier white oaks; it is slightly heavier than beech, hard maple, and sweet birch, and about equal to chestnut oak, burr oak, yellow birch, and white ash. It is cut and sold on the market without distinction, chiefly as longleaf pine.

Because of the trend of logging operations from the better drained hill land toward the flat lands, ponds, and swamps, larger amounts of slash are probably coming to the saw now than at any previous time. Slash pine is often closely associated with varying amounts of red gum, black gum, and cypress on a flat-land type that is being cut in increasing degree. In lower central and southern Florida, where slash is the only commercial pine, 16 sawmills reported for 1914 a cut of 121,500,000 board feet of yellow pine. While the total slash pine cut is represented by a very large figure, it is undoubtedly small in comparison with the total cut of longleaf. The importance of the species lies rather in the position it has assumed in the second-growth Southern forests and that which it will hold in the future timber and naval-stores industry of the South.

Coupled with the capacity of slash pine for producing large amounts of high-grade resin at an early age is its ability to thrive on lands so poor for agriculture that they will probably not be used or developed for a half century at least. Turpentining is extensively practiced—often by the wasteful boxing method—when the trees reach about 8 inches in diameter breast high. This would be at an age of 20 to 30 years in fully stocked stands on average sites and 12 to 17 years on good sites. By too heavy chipping the life of the tree is practically taken in three years, including the effect of subsequent losses by fire, drought, and wind, accompanied by fungi and insects. Under the French system of cupping and resting, these same trees could be worked for turpentine for 25 to 50 years or more. About 20 years ago Dr. Mohr wrote: "Even now on the coasts of South Carolina and Georgia a large proportion of resinous products is derived from the young growth of the (slash) pine, which after the removal of the original timber growth took possession of the ground." [15] The age of the trees referred to was 30 to 40 years, which at that time was considered as young for turpentining. The average minimum age now is nearer 20 years.

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[15] Forest Service Bulletin 13, p. 80.

The freshly exuded resin of slash is limpid and noticeably less viscid than that of longleaf, and during the season slash produces a considerably larger amount of "dip" and less "scrape" than longleaf. Operators all recognize the superior value of slash "gum" over that of longleaf as yielding a higher percentage of turpentine and a whiter resin.

The approximate yield and value in the tree of crude turpentine to be expected from a 25-year-old stand, worked for a period of three years, are shown in Table 2. The diameter and number of trees per acre are based upon actual stands on Quality I and II sites, the yields of gum upon estimates given the writer by four operators in young slash pine, and the value of the turpentine rights upon recent sales at $140 per thousand cups on the Florida National Forest. While the figures are only an approximation, it is believed that they fairly represent the conditions of such operations under ordinary good supervision.

TABLE 2.—*Yield and value of crude turpentine or "gum" from 25-year-old slash-pine stands.*

Year.	Dippings during year.	Yield of gum for year.			Value of turpentine rights.[16]			
		Per tree (1½ pints per dipping).	Per 1,000 trees.	Per crop (10,000 trees.)	Per cup or tree.	Per 1,000 cups or trees.	Per crop (10,000 cups or trees).	Per acre.
		Quarts.	*Gallons*	*Barrels*	*Cents.*			
First ...	10	8.0	2,000	1,600	5.60	$56.00	$560	$28.00
Second .	8+	6.5+	1,625	1,300	4.55	45.50	455	22.75
Third ..	7	5.5	1,375	1,100	3.85	38.50	385	19.25
Total.	25	20.0	5,000	4,000	....	$140.00	$1,400	$70.00

In Table 2, the 25-year-old stand is assumed to have 500 trees per acre, averaging from 7 to 11 inches in diameter breast high. At the rate of 1 cup per tree, 20 acres will be required for 10,000 cups, the number making a "crop" or standard working unit. A gross return of $70 per acre is shown for the period of growth of 25 years. Assuming that this was a natural stand and deducting the expense of taxes and interest on the investment in land would leave a very substantial profit for poor, sandy lands. If the yields of resin for the three successive years seems high in comparison with averages for the whole industry,[17] the capacity of slash over longleaf should be borne in mind; also that the stand is

[16] Turpentine permit sold on the Florida National Forest under terms of $1,400 for three years. The value assigned for the different years is based upon the yields for the corresponding year.

[17] "The Naval Stores Industry," U. S. Dept. of Agriculture, Bull. 229, p. 18.

being tapped at the period of its fastest growth—a very important factor in the production of crude turpentine.

A concrete example of what a young second-growth stand of slash pine is yielding in money from turpentine was found by the writer near Ridgeland, South Carolina. A 20-year-old natural stand on typical flat, sandy land was being turpentined. Well-stocked portions, where trees of the dominant classes averaged 7 to 10 inches in diameter breast high, contained an average of 520 trees per acre, with 1 cup per tree. Local prices for turpentine rights made this permit worth not less than 10 cents per cup.[18] Thus, in a period of 20 years without other expense than holding the land, the gross returns would amount to $52 per acre. Assuming, now, that the stand had been grown under management, the expense for the 20 years may be estimated under the following items:

Taxes, 20 mills on $2.50 land valuation, including interest at 4 per cent	$1.49
Protection, at 25 cents[19] per acre annually, at 4 per cent compound interest for 20 years	7.44
Supervision, 10 cents per year, including interest at 4 per cent	2.97
	$11.90

At a selling value of 10 cents per cup and deducting the above total cost of $11.90 per acre, it would leave a profit of $40.10 per acre, or 11 per cent compound interest on the original investment of $5 per acre for the land. This makes a yearly net return of about $2 per acre for a period of 20 years for the by-product of the stand. After a period of rest and growth of some three to five years, the stand would be in good condition for back-cupping, with an even larger financial yield. If not reworked, the stand can then be cut for small-dimension lumber, poles, or ties.[20] This is possible because of the high vigor and rapid growth of the species and apparent slight effect of turpentining, by approved government methods, upon the rate of development.[21]

The South, with its millions of acres of land too poor to be of agricultural value for a half century at least, is gradually giving attention to the economic question of putting its unused lands to their most profitable

[18] A conservative valuation for the product in the tree, considering the vigor of the trees and reduced cost of collecting.

[19] An exceedingly high estimate in a well-stocked stand.

[20] Heavy inroads are now being made upon young pine for sap ties.

[21] The result of preliminary studies on slash-pine stands under turpentine operations failed to show any decided evidence of direct injury. After turpentining, fires gain a better hold and seemed to be the chief cause of damage in relatively young stands.

use. In this connection slash pine stands out as a tree of very high commercial value. Incidentally it offers good promise of being successfully extended, chiefly for the commercial production of turpentine, over other portions of the subtropics, including South America and perhaps the Mediterranean countries. The facts regarding slash pine in the South and the experience of southern France clearly show that the growing of timber for turpentine purposes is a profitable business.

COMPARATIVE TEST OF THE KLAUSSNER AND FOREST SERVICE STANDARD HYPSOMETERS

By Douglas K. Noyes

In a recent remeasurement by the writer of a number of permanent sample plots established by the Forest Service in California in connection with a study of growth under different methods of cutting, a question arose as to the advisability of using the Klaussner hypsometer, rather than the Forest Service standard hypsometer, to secure heights of trees on the plots. To help in arriving at a decision, a comparative test of the accuracy of the two instruments was made. So far as is known to the writer, no data of this character have ever been published, and in view of the amount of such remeasurement work that is likely to be done from time to time in investigative work, a few brief notes on the result of this and other tests of the instruments, as well as conclusions as to the value of the Klaussner based on extensive use of the instrument in practical field work, may perhaps be of interest.

For test purposes it was necessary to measure with the instruments some object the exact height of which was accurately known. It was of course essential that the height be considerable, in order to approximate actual working conditions. As the test was conducted at a small mountain ranch, the surrounding timber constituted about the only objects at all suitable for the purpose. Accordingly, a tall, straight yellow pine was selected on flat ground. The tree was practically plumb.

The two instruments selected for test were not brand new, but both were in good condition and appeared to be in satisfactory adjustment.

A light line was carried to a point near the top of the tree, with bright red cloth markers fixed to it at 10-foot intervals. After the line was in place, it was tested with a steel tape to make sure that there was no appreciable stretching. The heights of the markers were found to be 103, 93, 83, 73, 63, 53, 43, 33, and 23 feet from the ground, respectively.

A point was selected 100 feet from the base of the tree, and careful sights taken on each marker with both instruments, the readings being verified by a second man in each instance. Owing to uncertain light conditions, it was found to be impossible to pick out the 93-foot marker with the Klaussner, so that a comparison of the two instruments for that point is not available. The comparative results of this test are shown in Table 1:

TABLE 1

True height.	Height with Klaussner hypsometer.	Error.	Height with Forest Service hypsometer.	Error.
103	101.8	—1.2	99.0	—4.0
93	.....	.....	90.0	—3.0
83	82.4	—0.6	79.0	—3.5
73	73.2	+0.2	71.0	—2.0
63	63.0	0.0	61.0	—2.0
53	53.4	+0.4	52.5	—0.5
43	43.4	+0.4	42.5	—0.5
33	33.0	0.0	32.5	—0.5
23	23.8	+0.8	23.0	0.0

An examination of the table will show that the average error shown by the Klaussner is only .45 of a foot, while that of the Forest Service instrument is 1.78 feet—practically four times as great. It will also be noted that the Klaussner used in the test is inclined to read a little low on trees over 75 feet high—about right on trees of medium height and high on short trees. The Forest Service instrument, however, reads consistently low on all the markers, the error increasing with the height. Based on the showing made, the Klaussner is considerably the more accurate of the two.

It must be admitted that the greater relative accuracy of the instrument is somewhat discounted by the constant presence of another factor which has a tendency to detract from the absolute reliability of the figures, as shown by the test described below. This test was designed to show how close an agreement could be secured between several recorded instrumental heights based on shots taken from the four sides of each of several trees. The absolute heights of the trees were not needed and were unknown. Three good-sized trees without perceptible lean, located on a 20° slope, were selected for test purposes, and their total heights determined with the instrument from the downhill side, the uphill side, and from opposite sides at points about level with the base of the trees. The variation in the recorded heights is shown in Table 2:

TABLE 2

	Direction of sight.	Distance to tree. *Feet.*	Height. *Feet.*
Tree No. 1.	Uphill	90	110
	Downhill	94	112
	Along slope	96	108
	Opposite along slope	89	112
	Average		110.5
	Extreme range of readings		4

	Direction of sight.	Distance to tree.	Heigth.
		Feet.	*Feet.*
Tree No. 2.	Uphill	75	101
	Downhill	88	96
	Along slope	89	101
	Opposite along slope	83	97
	Average		98.8
	Extreme range of readings		5
Tree No. 3.	Uphill	..	91
	Downhill	93	94
	Along slope	88	92
	Opposite along slope	..	..
	Average		92.3
	Extreme range of readings		3

It is evident, from an examination of the above results, that a variation of as much as five feet can be secured between readings on the same tree from different directions. Unfortunately, with something like 7,000 height measurements to be taken on the investigative project mentioned, financial considerations alone made it entirely out of the question to take the time for more than one reasonably careful measurement of total height on each tree. Since that single measurement might be three feet higher or lower than an average of several readings from different sides of the tree, there is no question but that the slight instrumental error displayed by the Klaussner in Table 1 can be disregarded in practical work.

Discrepancies such as are shown in the last test are not difficult to account for. They are partly instrumental, partly due to a lack of a precise point upon which to make the sight, and perhaps in some cases partly due to an imperceptible lean in the tree. The crown of a tall pine looks very different from different sides. If it is more or less flat and spreading, an uphill sight on the top of the tree may entail considerable guesswork on the part of the observer, because the edge of the flat crown is apt to obscure the topmost leader. Shots on the level often give the same trouble in less degree. Yet surrounding timber may make shots from these directions unavoidable.

It is to be regretted that press of other work made it seem best not to carry out a similar test with the Forest Service hypsometer at that time. Later on, however, such a test was made—not on the same identical trees, it is true, but under analogous conditions. The results secured are shown in Table 3:

TABLE 3

	Direction of sight.	Distance to tree.	Height.
		feet.	*feet.*
Tree No. 1.	Uphill	100	96
	Downhill	...	88
	Along slope	...	87
	Opposite along slope	...	91
	Average		90.5
	Extreme range of readings		8
Tree No. 2.	Uphill	...	105
	Downhill	...	110
	Along slope	...	107
	Opposite along slope	...	105
	Average		108.0
	Extreme range of readings		5
Tree No. 3.	Uphill	...	122
	Downhill	...	128
	Along slope	...	126
	Opposite along slope	...	124
	Average		125.0
	Extreme range of readings		6

The only conclusion to be drawn from these two tests is that while the Klaussner has somewhat the best of the argument on the showing made, neither instrument can be depended on to give accurate heights to the nearest foot, except under the most favorable conditions, on trees well within the limits of the instrument, and using every possible care in the work—and then only by averaging the results of several readings. Obviously, close results are out of the question when tall trees, running up to 150, 200, or 250 feet in height, are measured. Here the size of the trees makes it necessary to triple or even quadruple the direct reading in order to determine the height of the tree, thereby increasing the instrumental error in proportion. Even when—as is often the case—surrounding timber prevents the observer from sighting on the tree from 150 to 200 feet away, as should ordinarily be done in the case of a tall tree, the angle of sight is usually so high as to impair the accuracy of the measurement in any case.

Aside from the degree of absolute accuracy obtainable from these instruments, data regarding their behavior and speed when used on a considerable number of trees under actual working conditions may be of value. For this purpose a 60-minute test was made with the Klaussner on trees just as they happened to occur on the sample plot, recording all the data that was required in the remeasurement work—that is, diameter to .1 of an inch, total height, merchantable height in the case of mer-

chantable trees, height to base of crown, and a brief tree description. Twenty-five trees were completed within the allotted time. The Forest Service hypsometer was then substituted for the Klaussner and all the work repeated on the same trees. This took 43 minutes, or 72 per cent as long.

The idea followed in the test was not to make a speed record, but to ascertain, under actual working conditions, about what could be expected in the way of speed with each instrument, using the same care as would be used throughout the work on the project.

Table 3 gives the results from both instruments. An examination of the figures will indicate the ordinary run of discrepancies between the figures obtained with one instrument and those obtained with the other. It should be stated that in the two columns designated "Height to base of crown" the increased percentage of agreements between the two instruments is due to the fact that heights which did not exceed 16 feet were not taken with the instruments at all, but with a 10-foot pole.

TABLE 4

Tree No.	Total height.		Discrepancy.	Merchantable height.		Discrepancy.	Height to base of crown.		Discrepancy.
	Klaussner hypsometer	Forest Service hypsometer.		Klaussner hypsometer.	Forest Service hypsometer.		Klaussner hypsometer.	Forest Service hypsometer.	
229	48	46	—2	18	19	+1	18	19	+1
230	61	65	+4	20	25	+5	20	25	+5
231	105	104	—1	63	59	—4	34	34	0
232	67	64	—3	25	34	+9	16	20	+4
233	20	24	+4	...	...	...	10	10	0
234	69	68	—1	34	37	+3	7	7	0
237	32	31	—1	...	...	...	4	3	—1
238	72	73	+1	36	49	+13	7	7	0
239	30	29	—1	...	...	...	4	4	0
240	114	107	—7	87	79	—8	27	25	—2
241	39	36	—3	...	...	...	6	5	—1
242	35	34	—1	...	...	...	2	2	0
243	49	47	—2	...	...	...	9	7	—2
244	69	66	—3	16	16	0	5	4	—1
245	44	42	—2	...	...	...	27	24	—3
246	135	124	—11	107	96	—11	43	38	—5
248	134	144	10	112	109	—3	36	35	—1
249	101	99	—2	74	57	—17	7	8	1
250	70	67	—3	28	29	1	20	20	0
251	19	18	—1	...	...	...	2	2	0
252	63	64	1	27	27	0	9	10	1
515	106	111	5	81	86	5	36	38	2
516	78	71	—7	20	25	5	26	28	2
519	74	74	0	36	31	—5	9	8	—1
521	105	99	—6	63	65	2	26	28	2

It will be noted that quite wide discrepancies occur in the above table in some instances, and that in general the disagreements are not confined to any one size of tree. The trouble is partly due to a different location of the observer when the second reading was taken, partly to actual instrumental error, and perhaps partly, in the case of the Forest Service instrument, to the mental arithmetic involved in the determination of height, the algebraic sum of two readings being required in the use of this instrument. Mental arithmetic of this sort is very apt to be a source of error, especially toward the close of a hard day's work.

The above tests were made comparatively early in the work. Later on it was found that the working speed of the Klaussner shown above could be exceeded somewhat through greater familiarity and skill in handling the instrument. For example, 30 trees per hour at random could be covered, while in the case of small trees, not exceeding 40 feet in height, as many as 45 could be completed in the same length of time if conditions were favorable. Large trees took two and a half minutes apiece to dispose of, on the average.

Although it may be admitted without argument that the Klaussner hypsometer is only from 60 to 80 per cent as fast as the Forest Service hypsometer, depending on the size of the timber encountered, nevertheless it was decided to adopt it for the work on the project because it has a number of advantages over the other instrument which, in the opinion of the writer, were sufficient to outweigh the disadvantage of slowness. These are the following:

(1) It is on the whole less erratic in its readings, as evidenced by the results of the tests described.

(2) It eliminates most of the mental arithmetic required by the Forest Service hypsometer, because the total height can be obtained by a single reading.

(3) On steep ground the tape does not need to be held level in measuring off the distance from tree to instrument. The direct distance to the eyepiece of the instrument is all that is required.

(4) Any distance that is suited to obtaining a good sight on the tree may be used, instead of only 50 feet or multiples thereof. This is extremely important if a thick growth of young saplings and poles is being measured, where it would often be impossible to lay off the standard distances because of the interference of other trees.

(5) A fixed distance from tree to instrument not being required, sights may be taken from a single set-up to as many different trees as may be convenient by simply obtaining the distance from tree to instrument and setting the sliding vertical bar at the proper point in each case.

(6) It is used on a tripod or Jacob staff instead of being held free-hand, which tends to increase the accuracy of the readings in the long run, allows readings to be checked with ease before being passed on to the tallyman, and eliminates most of the strain on eyes and arms caused in a day's work.

It should of course be understood that it is not intended, in drawing such comparisons, to cast any aspersions upon the Forest Service hypsometer within its particular field, which is the rapid and reasonably accurate determination of heights in reconnaissance work. In that field it is probably without a rival.

It might not be out of place before closing this paper to outline the chief disadvantages in the design of the Klaussner now in common use for scientific work and to point out how they might be overcome.

The chief trouble with the instrument as now made is that it is not fully adapted to measuring such tall timber as is found in Pacific Coast forests. The Klaussner is based on the well-known principle of similar triangles. Its three principal members are constructed in such a manner that by proper sighting and measurement from tree to instrument they can be set to reproduce on a small, predetermined scale a triangle with exactly the same proportions as that formed by the lines of sight from the instrument to the base and top of the tree respectively. When the instrument is thus set, the scale on the vertical bar gives a reading which is the height of the tree. If, however, the bars forming the three sides of this instrumental triangle are short, as is the case in the present Klaussner, the dimensions of the tree under measurement may be such that the graduations provided on the instrument are too few to represent the actual distance on the ground. To illustrate: The number of graduations on the horizontal scale of the Klaussner is only 60. If a 200-foot tree is being measured, the observer should back off some 180 feet in order to get a proper sight on the top. Under those circumstances each of the graduations on the horizontal scale would have to represent three feet of distance, and the actual reading on the vertical scale would have to be multiplied by three in order to get the true height of the tree. Sometimes the reading even has to be quadrupled. This is a bad defect because it increases the instrumental error in proportion. The difficulty was of course hardly contemplated when the instrument was first designed, because it was not intended for use in such tall timber.

It is suggested that this difficulty could be avoided by increasing the length of the three bars sufficiently, so that the horizontal and vertical bars can be made to carry graduations up to 250, with about one-thirtieth of an inch interval, and the sight bar to intersect the vertical bar

when set at an angle of 45°. At the same time the thumb-screw, by means of which the slanting sight bar is raised and lowered, should also be lengthened, so that the latter may be raised, if desired, to an angle of 60°. Then when the interference of surrounding timber makes it necessary for the observer to work at a shorter distance from the tree than would otherwise be the case, the sight bar can be raised above 45° without its becoming necessary to set a small block between it and the bearing point of the screw in order to give the necessary lift. This is an annoying and time-consuming operation that must often be resorted to in the present instrument.

One or two other minor changes may also be suggested. The vertical bar now consists of a flat metal ribbon. It is too light to stand up in continuous service under rough field conditions without sooner or later becoming bent. Once bent it is hard to straighten perfectly. It should be made as heavy and stiff as the other two bars.

It is quite possible that the increased length of the instrument would require that it be made heavier throughout in order to secure the necessary stiffness. However, its outside dimensions would still be under 12 inches, and the loss in lightness and compactness would be more than offset by its greater accuracy and convenience in work of the character described. The amount of such work that is likely to be done by an organization such as the Forest Service from time to time should be amply sufficient to justify the expense of constructing an instrument of special design to meet the conditions encountered.

DOLLARS AND SENSE

By Donald Bruce,

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During the past few years the logging engineering movement has grown at a rapid rate. But yesterday the term was almost unknown to the forester, while today certain forest schools are concentrating their best efforts on the training of men for this profession. So rapid a trend toward even a desirable goal makes inevitable a reaction, and there is every sign that this is now upon us. Mr. Olmsted's admirable article, "What is a Forester?" in the April number of the Proceedings, is its most definite expression, though many another voice is being lifted in words of warning against forgetting the fundamentals of forestry in the enthusiasm for what is considered little more than a passing fad. Both action and reaction are normal and healthy; but, though the latter will doubtless correct a tendency toward undesirable extremes, it should not be allowed to check a sane and well-balanced progress.

"Silviculture is the key-note of forestry, and the logging engineer is not a forester at all," is the stand taken by many today. I am inclined to feel that both of these statements are extreme, and that their plausibility rests upon a loose definition of the words *forestry* and *silviculture*. The latter is often defined too broadly and the former too narrowly, with the result that they become almost synonymous. "Silviculture is the production of wood crops," but the word production must not be interpreted to include the harvesting of the crop. Forestry, on the other hand, should be defined, surely, with great breadth. It must include not only silviculture, but forest protection, management, and utilization as well. The harvesting, yes, and the marketing of the crop of grain is as much the work of the farmer as is the sowing of the seed. It is true that both forester and farmer may find it desirable to employ experts for special problems, but the field of these problems is not thereby eliminated from forestry and farming. Suppose the logging of the timber crop is turned over to the civil and mechanical engineer and its marketing to the advertising and traffic expert and to the lumber salesman. Why stop there? Why not give over the mapping to the surveyor, the protection from insects and fungi to the entomologist and pathologist, the financial calculations to the accountant, the tree studies to the botanist, the studies of site conditions to the soil technologist and climatologist, the estimating

of the timber to the professional cruiser? One begins to wonder what would be left for the forester himself to be. As a matter of fact, of course, the forester must, in a measure, be all of these things. He himself must handle much current work along any of these lines and have a sufficiently thorough insight into each to know when and how to employ highly specialized assistance. He may very probably find it advisable to specialize, himself, in that particular field of the greatest importance to him. It will doubtless be admitted without question that a man *merely* a botanist, an entomologist, a surveyor, or a mechanical engineer is not a forester. Many logging engineers have an equally poor claim to that title, but it is because of their lack of a certain essential knowledge and point of view rather than because their special field is not a part of forestry; and, I submit, it would conceivably be equally possible for a silviculturist to fall as far short of being a forester.

Granting that forestry includes utilization as well as silviculture, the end as well as the beginning of the forest crop, is it not a questionable statement that the latter is of dominant importance? To argue this is somewhat like disputing whether the cat's head or body is more essential to its welfare; we doubt whether it would be a very good cat without either. But surely the farmer can be excused who in the rush of a busy harvest time puts aside for the moment any anxieties over the way he will sow his seed. True, the forester's seed time and harvest are simultaneous. But if he lives in a State which at the present rate of cutting has a three hundred years' supply of mature timber in sight, surely he can be forgiven if for the moment he concentrates his greatest efforts on its economical logging and marketing.

As a matter of fact, American forestry owes a bigger debt to the forest or logging engineering movement than is commonly recognized. In its inception forestry in this country was more a cause than a profession. The pioneer forester carried into his work a zealous enthusiasm admirably calculated to arouse the nation to the critical nature of its forest problems. A decade later conditions had changed. The conservation movement was accepted by the people in a broad way, and the struggle against it began to be on matters of detail rather than of principle. Here the very zeal that accomplished so much at first became at times a hindrance. It resulted in many a hasty blunder difficult to explain to a more critical and discerning public, and not calculated to win friends from the ranks of timber owners and operators. The professional forester, of course, rapidly adapted himself to the changing conditions. Instead of treating the lumberman as a bitter enemy of the forest, and therefore of the forester, he began to realize that he needed him as an ally, even that he

could learn something of forestry from him. Today lumberman and forester work cordially together for the most part, and the key-note of their friendship is the forest engineering movement.

The gain to the forester is not only in the strength of the new friend, but in a valuable new point of view. This is set in high relief by voices heard from time to time which seem echoes of the old crusading spirit. Even yet unthinking applause is often accorded to some particularly intricate and expensive silvicultural plan, and equally lightly considered blame is placed upon the forest owner who does not practice it. It seems that there still lingers a feeling that the most expensive and elaborate silviculture is necessarily the best silviculture. Yet this is like lauding the "gentleman farmer" whose milk and champagne cost him an equal amount per quart. Surely what is the soundest silviculture can only be determined when the financial aspects are considered, and the gentleman farmer is the less a farmer for his foolish and nonproductive expenditures. It is this "dollars and sense" point of view that the logging engineer is always emphasizing, and while he can claim no exclusive title in it, the present appreciation of its importance is largely due to his influence.

A recent sample marking on a National Forest timber sale illustrates this. In general the marking policy was well crystallized and the marking board was in agreement. Over a few trees, however, discussion arose, and in every case the argument was between the point of view of the logging engineer and of the silviculturist. Perhaps a small, limby, unhealthy specimen was found. Said the silviculturist: "Mark it for cutting; it won't live until the next cut; it is holding back that thrifty clump of reproduction and is occupying valuable space in the forest." In reply the logging engineer would say: "Yes, but that tree cannot be handled except with a loss. If you mark such trees, you must reduce your average stumpage price, and hence virtually pay the purchaser for their removal. In fact, the cost of removing that tree will far exceed any damage it can do by remaining." Qualitatively both arguments were sound, but in order to choose between them a common denominator had to be found, and the only one available was, of course, the dollar. It was interesting to realize that neither logging engineer nor silviculturist was quite ready to express his argument quantitatively, though the former was the more ready of the two. He could estimate fairly well the low value of the lumber which could be sawed from such a tree and the high cost of putting it through the mill as compared to the average for the stand. The silviculturist, on the other hand, could make but the wildest guess at the dollars and cents damage to the stand that would result from leaving the disputed tree in it.

A few years ago, to judge from the current marking rules of that day, the silviculturist was fairly well satisfied with his conclusions. He would have marked such a tree as has been described with gusto, and with scarcely a second thought. Perhaps he would have been right in so doing. But surely he would not have been right in his failure to fully analyze all of the effects of his action. If the logging engineer is stimulating a development of the quantitative phases of silviculture, surely forestry owes him a debt of gratitude on that account.

Forestry should hesitate before it disowns the logging engineer. If he has the proper point of view, he will be a most powerful ally in more ways than one. Whether in the future he will be so trained as to have just claim to the title forester is as yet undecided. The decision rests largely with the professional forester of today through his control of the forestry educational system. He has every reason to use his best efforts to see that the logging engineer of the future is worthy of the broader term, forest engineer.

Mr. Bruce has kindly consented to let me comment briefly on his paper in reply to "What is a Forester?" His article is an excellent statement from the viewpoint of the logging engineer, and I trust that the subject may later on be discussed in its other phases.

My own article touched upon logging engineering in reply to Mr. Cornwall's statement that "a knowledge of logging engineering is the basis of true forestry," and my paragraph on the subject was intended to show that this was far from true. I did not assert, nor have I any intention of claiming, that a logging engineer cannot also be a forester, for in case he has the training, the practical experience, and the viewpoint of the forester, and provided he applies this knowledge in connection with his engineering work, he should make a very good one indeed. The forester, on the other hand, without specialized training and practical experience in civil and mechanical engineering, would make but a poor logging engineer. It is conceivable that one might be a thoroughly efficient logging engineer without any knowledge of forestry whatsoever, and in this case one's harvesting of the crop only from the standpoint of the greatest immediate profit might work irreparable damage to the forest of the future. It must be granted without argument, I think, that forestry, as distinguished from lumbering, aims chiefly at providing trees for the future, for otherwise the forester would be simply a lumberman.

As a matter of fact, the various specialized branches of forest work mentioned by Mr. Bruce are already turned over to experts. Much of

the surveying and mapping connected with forest valuation is done by civil engineers with no knowledge of forestry; protection from insects and fungi is now largely left to entomologists and pathologists; financial matters are attended to by accountants, and tree studies are in the hands of dendrologists. Similarly, it would be quite in place for the forester to entrust the harvesting of the crop to the logging engineer, directing his operations in such a way as to insure the application of those silvicultural methods suited to the given forest and economic conditions.

Silviculture, regardless of its financial aspect, is, of course, not silviculture at all, and those enthusiasts mentioned by Mr. Bruce who lack sense to regard dollars are not foresters at all. By the same token, if the logging engineer is to be a forester also, he must consider the dollars of the future as well as the immediate gain in pennies. The cost of logging and milling any certain individual tree is not a determining factor in the success of a logging operation as a whole, nor is it of vital importance precisely what value a certain group of young trees may have fifty or a hundred years from now. The assumption that such trees will then be valuable seems quite as fair as the statement that there is now a supply of mature timber in sight in this country which will last for three hundred years at the present rate of cutting. Moreover, regardless of the available supply, the importance of applied silviculture will rapidly increase as the stumpage diminishes, the stands become more and more inaccessible, and the logging more costly.

The forester has always regarded the work of the logging engineer very highly and, to the best of my knowledge, has never attempted to minimize its importance. If what Mr. Bruce terms "reactionary" tendencies really exist, I should take this reaction to be a healthy movement leading back toward more rapid progress in the basic aim of forestry.

F. E. Olmsted.

September 18, 1916.

EVAPORATION AND SOIL MOISTURE IN RELATION TO PLANT SUCCESSION

By Clarence F. Korstian, M. F.,

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Phytogeographers have long recognized heat and moisture as fundamentally important in determining the character and distribution of plant formations. Only within the last decade, however, has material advancement been made by phytoecologists in the quantitative measurement of the water relations of plants. With uniform soil conditions the amount of available moisture is frequently the determining criterion of a plant formation. Ecologists have repeatedly shown that the evaporating power of the air affords a rather concise and satisfactory summation of the combined effects of temperature, humidity, and air movement in so far as these factors affect transpiration.

Fuller[1] presents a series of detailed quantitative data on evaporation and soil moisture and shows very clearly their intimate relation to plant succession. The Livingston cylindrical porous cup atmometer was employed in securing the evaporation records. Three or more stations were maintained in each association at which evaporation and soil moisture data were secured. Data were obtained for three successive growing seasons; in 1910 extending over 178 days from May 6; in 1911 a period of 180 days from May 1 was covered, and in 1912 for 172 days from May 3. The successional series of associations extended from the cottonwood dune, through the pine dune, oak dune, and oak-hickory associations, to the climax beech-maple forest association; all of which occur in northeastern Illinois and northwestern Indiana.

The cottonwood dune association is characterized by a single tree species, *Populus deltoides,* and a paucity of shrubs and herbs; all of which possess xerophytic structures. Other prominent species of the association are *Salix glaucophylla, S. syrticola, Prunus pumila,* and *Cornus stolonifera.*

The pine dune association is dominated by *Pinus divaricata,* associated with *Juniperus virginiana, J. communis,* and in older portions with *Pinus strobus.* In the undergrowth *Arctostaphylos uva-ursi* is conspicu-

[1] Fuller, George D. Evaporation and Soil Moisture in Relation to the Succession of Plant Associations. Botanical Gazette, 58: 193-234. 1914.

ous, associated with *Rhus canadensis, R. toxicodendron, Prunus virginiana,* and *Celastrus scandens.*

Proceeding inland from the lake shore, the pines gradually decrease in number, and the black oak (*Quercus velutina*) increases until it forms an almost pure stand, with occasional trees of white oak (*Quercus alba*). Among the principal shrubs of the undergrowth *Prunus virginiana, Rosa blanda, Viburnum acerifolium, Vaccinium pennsylvanicum,* and *Ceanothus americanus* should be mentioned.

By the invasion of more mesophytic trees, notably the red and white oaks (*Quercus rubra* and *Q. alba*) and one or two species of *Hicoria,* the oak dune association is superseded by the oak-hickory forest association. Such floodplain species as the white ash (*Fraxinus americana*), the elm (*Ulmus americana*), and the black walnut (*Juglans nigra*) occur in the depressions of this association.

The climax of mesophytic conditions is represented by a forest composed principally of beech (*Fagus atropunicea*) and sugar maple (*Acer saccharum*), with occasional individuals of *Tilia americana, Liriodendron tulipifera,* and *Prunus serotina.* The undergrowth is characterized by such shrubs as *Asimina triloba, Sambucus racemosa,* and *Evonymus americanus.*

The author facilitates the comparison between the various stations and associations by the use of 27 text figures, which show graphically the average water loss per day and the range of soil moisture.

The average daily amounts of evaporation as recorded for the various associations in the order of their successional sequence are: Cottonwood dune, 22.3 cc.; pine dune, 10.4 cc.; oak dune, 11.0 cc.; oak-hickory forest, 8.8 cc., and beech-maple forest, 7.0 cc.

Fuller makes a notable advance in the study of the water relations of plants by advocating the use of the ratio between evaporation and the available water or the chresard proposed by Clements,[2] calling it "growth-water"—*i. e.,* the amount of water which is actually available for absorption by the organism. The ratio between evaporation and growth-water was found to vary inversely with the degree of mesophytism, being 11.7, 10.7, 9.4, 2.8, and 1.8 for the cottonwood dune, pine dune, oak dune, oak-hickory, and beech-maple associations, respectively.

Of Fuller's conclusions the following are of special interest:

"The rate of evaporation in the cottonwood dune association, both by its great amount and by its excessive variation, seems a quite sufficient cause for the xerophytic character of the vegetation and for the absence of undergrowth, in spite of the constant presence of growth-water.

[2] Clements, F. E. Research Methods in Ecology. 1905.

"The pine and oak dune associations resemble one another closely both in their mean evaporation rates and in their supply of growth-water. The former is slightly more xerophytic during the midsummer weeks.

"The vernal vegetation of the pine dune is quite as mesophytic as that of the succeeding association, thus agreeing with its lower evaporation rates during that portion of the year.

"The evaporation rates and the amount of growth-water in the various associations vary directly with the order of their occurrence in the succession, the pioneer being the most xerophytic in both respects.

"The ratios between evaporation and growth-water in the beech-maple forest, oak-hickory forest, oak dune, pine dune, and cottonwood dune associations have been shown to have comparative values of 100, 65, 20, 17, and 15, respectively, and the differences thus indicated are sufficient to be efficient factors in causing successions."

Weaver,[3] in a study of evaporation within certain grassland and forest associations of Washington and Idaho, contributes additional quantitative data concerning the factors causing the succession of plants. The succession is from the bunchgrass-rimrock association (dominated by *Agropyron spicatum*) to a climax forest of western red cedar (*Thuja plicata*). The records extended over a period of 126 days, beginning May 7, 1912. The average daily amounts of evaporation for the various associations taken in the order of their occurrence in the succession are given as approximately 28 cc. for the bunchgrass-rimrock association, 23 cc. for the prairie with southwest exposure, 17 cc. for the prairie with northeast exposure, 11.8 cc. for the western yellow pine (*Pinus ponderosa*), 9 cc. for the fir-tamarack association (dominated by *Pseudotsuga taxifolia* and *Larix occidentalis,* with small amounts of *Abies grandis* and an occasional *Picea engelmanni*), and 8 cc. for the climax cedar forest association. By using the evaporation in the mesophytic cedar forest as the basis of comparison, Weaver shows that in the fir-tamarack association atmospheric conditions in the lower stratum are 120 per cent as severe, in the average prairie of the plains 250 per cent, and in the bunchgrass-rimrock association 345 per cent as unfavorable for plant growth as regards the evaporating power of the air. The rate of evaporation in the mesophytic western red cedar forest was found to be almost identical with that recorded by Fuller[4] for the climax mesophytic forest of the eastern United States, as exemplified by the beech-maple forests of the southern Lake Michigan region.

The valuable suggestions of Fuller that a climax mesophytic forest association of wide distribution, such as the beech-maple forest of the

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[3] Weaver, J. E. Evaporation and Plant Succession in Southeastern Washington and Adjacent Idaho. Plant World, 17 : 273-294. 1914.

[4] Op. cit.

eastern United States, should be adopted as the basis for comparison, and that the conditions in other plant associations should be expressed in the same comparable units should be welcomed by forest ecologists. It is evident that it is possible to make rather accurate comparisons of the conditions within the forests of the east and the west and to quantitatively determine their relative mesophytism. The differences in the evaporating power of the air in the different associations show that this factor is extremely important in causing plant succession.

SILVICAL NOTES ON WESTERN LARCH

By J. A. Larsen,

Forest Examiner, Priest River Experiment Station

Western larch, *Larix occidentalis* Nutt., is one of the most important timber trees in northwestern Montana and northern Idaho. It grows generally on the Columbia River drainage, north of an east-and-west line drawn 15 miles south from Missoula, and only west of the Continental Divide. The present estimate for the State of Montana in principal timber trees is 54 billion feet, of which lodgepole pine constitutes 28 per cent, western larch 24 per cent, Douglas fir 24 per cent, yellow pine 17 per cent, and Engelmann spruce 7 per cent; plus 10 billion feet miscellaneous species, including western red cedar, western white pine, cottonwood, and white fir. The annual timber cut of 219 million feet b. m. for the State is divided between western yellow pine with 45 per cent, larch 30 per cent, Douglas fir 15 per cent, and the remaining species, including Engelmann spruce, lodgepole pine, and western red cedar, 10 per cent.

This species has been known to attain an age of seven hundred years and about 7 feet in diameter. The oldest stands studied by the writer were 380 years, where the highest trees reached 175 feet in height and 55 inches d. b. h. outside the bark; the average diameter b. h. of 30 inches outside the bark, and an average volume of 1,500 board feet per tree and 60,000 board feet per acre. While this is not an exceedingly heavy stand, nor representative of the largest trees found, it is believed to represent a maximum in timber of this age on quality I soil.

The bole, as well as the root and crown, is capable of considerable variation in development, according to the nature of the site, elevation, and density of the stand. Since reproduction in the open on average good soil is very dense, the trees which form a part of the final stand are forced to maintain a rapid height growth; so that in the effort to avoid suppression the larch grows in height at the expense of lateral development, thereby producing many thin whips with small tufts of crowns at the tip which are not able to maintain their growth nor keep in upright position under heavy loads of snow and sleet.

The crown is short in comparison with white pine, Douglas fir, and the other tolerant species, and what is lost in length must necessarily be made

up in width. After 80 years the height growth abates in a very marked degree, when stouter and longer, rather rigid and brittle, lateral branches develop from the earlier slender pliant limbs. This change takes place in the lower part of the crown first, proceeding upward with the increasing age; so that at an age of 200 years the rigid laterals extend to the tip of the crown, giving the tree a tall frustrum form.

At higher elevations, and especially on poorer sites, the bole and crown are shorter and more tapering, so that the lower branches appear abnormally long in proportion to the upper. Trees 225 years old at 4,500 feet elevation on a gentle southwest slope averaged the same in diameter as trees 150 years old on bottom land at 3,200 feet, and the former were not as tall as the 150-year-old trees.

In mixture with spruce, white pine, Douglas fir, and the other tolerant trees, larch prunes itself remarkably well up to the very base of the crown, leaving the bole clean at a comparatively early age; but dead limbs may persist longer on the lowest portion of the stem, where there is less abrasion by the branches of adjacent trees.

The root system of the larch varies greatly in trees of different ages and in different situations, and the variations in soil and subsoil appear the most potent factors, inducing a diversified root development. On deep soils, offering none or few obstructions to growth, the root at from ten to fifteen years exhibits a long, deep, and slender tap showing the beginning of laterals, leaving the main root from four to five inches below the ground line. The laterals are confined to a vertical distance of not over six inches on the tap root. At fifty years the tap root has acquired greater thickness, is more tapering, but has not grown proportionately in length. The size of the laterals, however, are materially increased, and these have also produced vertical roots, which do not branch immediately below the main laterals, but are lost in a definite bunch of ramification two feet or so below and well within the hard substratum. While the increase in short vertical roots keeps pace with the elongation of the main laterals, the development of the former is limited according to the nature of the site, so as to obtain the maximum holding capacity and resistance to windthrow.

On gravelly soils and slopes where there is no marked division between soil and subsoil the main lateral roots are fewer, larger, strike deeper, and have a more restricted development of the small vertical roots.

Due to the well-developed root system, its adaptation to the peculiarities of the site, and the fact that the crown is comparatively open and free from foliage during winter storms, the larch is more windfirm than any of its associates. Older larch on bottom land and lower benches are more

windfirm than the younger, because the latter have barely had time to send the roots to a sufficient depth.

A scant amount of seed is produced every year in different localities, but abundant seed crops occur at less frequent intervals than for western white pine and yellow pine. The seed is ripe by September 1; is small, numbering up to 270,000 per pound clean, and retains its vitality under storage well, having germinated 20 per cent in sand in the greenhouse after the fifth year. From field and nursery work it was found that the seed requires considerable moisture and heat, up to 90 degrees Fahrenheit, for successful germination; and if the conditions are not favorable the first year, it will germinate early during the first warm days of the second season while soil moisture is still abundant.

Reproduction on burns and bare mineral soil is prompt and uniform, but poor on grasses, heavy sod, litter, and raw humus. It is entirely absent from dry south and west slopes. Experiments conducted at Priest River Experiment Station, Priest River, Idaho, reveal that germination and survival is best and most dependable on a sandy flat which supported a young stand of larch and Douglas fir, fair on unprotected northeast slope, and that germination, but no survival, results on a southwest slope with Douglas fir and yellow pine. The seedlings die during the dry, warm days of July and August of the first year.

Larch makes best growth on land supporting Engelmann spruce, cedar, hemlock, and western white pine. A study of larch and spruce mixture on nearly level land bordering a small creek showed that the average larch tree there at 110 years had a diameter of 15.8 inches b. h. and an average of 266 board feet per tree, compared with 13.5 inches in diameter and 174 board feet at 136 years on larch-Douglas fir slope land. On the poorer slope land, in mixture with Douglas fir, larch averaged between 8 and 9 inches in diameter and 70 to 80 board feet per tree at from 140 to 150 years. The following table, made from plots on larch-Douglas fir slopes, represents an approximate average of all sites and shows the relation between height, volume, and age.

Age	10	20	30	40	50	60	70	80	90	100	120	140
Height	12	23	33	43	50	58	65	70	77	82	90	94
Vol. bd. ft.....	..	..	..	..	5	10	20	30	45	55	85	120
Vol. cu. ft.....	..	..	1.3	2.5	3.8	4.8	6.7	8.9	10.8	13.2	19.0	26.0

A clearer idea of distribution and inter-relations of species within the larch-Douglas fir-white pine region may be gained by listing the trees in order of their demand for soil moisture, placing the most moisture-loving first.

On wet ground.	Engelmann spruce, *Picea engelmanni*. Western hemlock, *Tsuga heterophylla*. Western red cedar, *Thuja plicata*. Alpine fir, *Abies lasiocarpa*.
On moist or intermediate ground.	Western white pine, *Pinus monticola*. Grand or white fir, *Abies grandis*. Western larch, *Larix occidentalis*.
On dry sites.	Lodgepole pine, *Pinus contorta* var. *Murrayana*. Douglas fir, *Pseudotsuga taxifolia*. Western yellow pine, *Pinus ponderosa*.

The following list shows the same species in order of their tolerance, placing the most tolerant first: Western red cedar, western hemlock, white fir, Engelmann spruce, western white pine, Douglas fir, lodgepole pine, western larch, and western yellow pine.

The position of alpine fir is somewhat uncertain, but will probably be between the spruce and the white pine.

The arrangement of these trees in order of their altitudinal range, placing those that go highest first, will be as follows: Alpine fir, Engelmann spruce, lodgepole pine, Douglas fir, white fir, western larch, western red cedar, western white pine, western hemlock, and western yellow pine.

If arranged in order of their ability to resist injury by surface fires, we would have: Western larch first, followed by western yellow pine, Douglas fir, lodgepole pine, western white pine, white fir, spruce, cedar, hemlock, alpine fir. The relative position of the last six is uncertain.

In the first rotation of a new stand after the earlier has been destroyed by fire, larch will appear with all of these species below 5,000 feet elevation, except on the more severe sites, such as the steep and dry south slopes.

Following a severe burn on sites where all or most of the various species were present, reproduction of all these will be promiscuous and good and all will have an even start; but since the larch grows relatively faster than the rest during the early years, it is present in considerable numbers at the end of the rotation, even on land which would properly revert to spruce, cedar, and hemlock. The main point at issue is whether or not the drought or damping off during the first year eliminates the larch, this being the most critical period in the life of the tree. The seedlings require unobstructed sunlight for continuous good growth, however, so that there is no reproduction under other species nor under a full stand of larch itself. In this respect it is at serious disadvantage, because Douglas fir, lodgepole pine, and spruce usually come in under it and

occupy the ground to its exclusion; so that unless fires come to its rescue by killing out the tolerants it cannot remain in the stand indefinitely.

From a standpoint of natural preference, and not affected by fires, larch thrives best on the drained lower slopes, especially those with north or east aspects and on moist sandy flats and benches. It is necessary that the upper six inches of the soil maintain at least 5 or 6 per cent moisture during the very dryest period, otherwise larch will not become established, for the seedlings dry out readily.

Wherever the ground water comes close to the surface the year around, as near meadows and creek bottoms, larch may be present in the first generation and grows well, but suffers greatly from butt rot. On such sites spruce, cedar, hemlock, white fir, appear to much better advantage and prevent all larch reproduction completely.

On slightly higher and intermediate ground, mesophytic in character, the association during the first generation is usually larch, western white pine, Douglas fir, spruce; but larch will be crowded out from this also, because the seedlings cannot live in their shade. There remain, therefore, sites intermediate in character between the very driest occupied by yellow pine, Douglas fir, white pine, spruce, and white fir, such as lower slopes, sandy benches, and glacial formations with considerable clay, where larch survives longest because it is least molested by intruders. Areas under this head are comparable with the rolling glacial formations and higher benches, but even here it is denied a permanent location, because the shade cast by Douglas fir in the mixture and the dense reproduction of fir prevent larch seedlings from becoming established.

Influence of Climate and Fire on Larch Distribution

The climate within the region where larch appears at its optimum exhibits a remarkable absence of extremes, principally because it is south of the normal path of high and low pressure areas and is sheltered and separated from the continental type of climate to the east. The most marked changes are from extreme cold to the mild produced by the chinook winds. The spring and summer rainy season begins about the first of May and continues well into July, with a second precipitation period from November 1 to the end of January. The snowfall is very heavy in the mountains, affording perennial flow to most streams. It follows from the protected character of the location that this region has a milder winter, a greater precipitation, more cloudy weather, and less high winds than Montana east of the Continental Divide.

Locally also the larch exhibits a seeking after the intermediate or mesophytic sites; it avoids ridges and slopes exposed to dry winds and

maximum ranges in temperature, seeking northerly aspects, gulches, gentle slopes, and benches. It does not appear very thrifty or in great number above 5,000 feet elevation and is entirely absent from the eastern slopes of the Rocky Mountains, where the winds have a greater drying effect. The amount of precipitation necessary to sustain larch west of the Continental Divide lies between 18 and 20 inches annually. This amount would not suffice for its maintenance east of the Rockies.

In a discussion bearing on the relative fire resistance of the species, it may be well not to lose sight of the fact that the more intolerant trees have acquired the ability to grow on drier and more exposed sites, and have therefore developed thicker bark and other fire-resisting attributes, while the more tolerant and moisture-loving have not been forced to evolve the same qualities, at least not in the same degree, but other qualities more suited to their habitat; and trees which are the products of moist areas are more tolerant than those accustomed to inhabit dry regions. It follows that a scale of tolerance roughly points to a scale of moisture requirement. By reference to the list of tolerants it will be seen that larch stands first and is followed by yellow pine, Douglas fir, with the comparatively tolerant western white pine and the tolerant cedar, spruce, hemlock, and white fir at the opposite end of the list.

A severe burn in mature timber where larch and most of the other species mentioned were present leaves a larger proportion of larch among the uninjured trees than of any other species. The larch is therefore placed in an advantageous position as regards reproduction and seed-bed. The larger fires often run with great rapidity, skipping strips of timber in the gulches lying transversely to the direction of the path of the fire, thus making it possible for the remaining species to preserve uninjured representatives in the live timber; but since the more tolerant species, being also more moisture-loving than larch, do not reproduce as readily over the wide stretches laid bare by the fire, this ground is claimed more by larch and lodgepole pine. The influence of repeated fires is therefore to limit more and more the areas occupied by the tolerant trees and to extend the distribution of larch and lodgepole pine. This is what has happened in the past, for there are few places within the valley suitable for larch growth where this species is not found.

From what has been said in the foregoing paragraph it will readily be seen that larch and lodgepole pine compete on fresh burns. In this connection larch is favored by a slightly more rapid height growth, taller form, and the ability of individual trees to remain uninjured where all the lodgepole pine is killed. Isolated monarchs of larch, representing different ages and bridging several severe fires, are of common occurrence.

These are left even more secure from injury after each conflagration, because they become more and more isolated and develop thicker bark. But because of the ability of lodgepole pine cones to remain unopened for a great many years and preserve the seed from injury, reproduction of this species and its reclamation of the ground after fire is always prompt. Even should all the parent trees be destroyed, a successful new stand will result from seed liberated from the cones of the succumbed trees. Ordinarily, when a fire sweeps the same tract a second time before the down timber is decayed, the heat of the subsequent fire is more intense and closer to the surface than that of the first, whereby a second burning destroys more of the seed on the ground, namely, the seed of larch, Douglas fir, and other species which were liberated from the cones without the aid of heat. It also destroys seedlings of all species, including lodgepole pine; but since the seed of the latter is held in the cones and on the trees and shed after the fire, it naturally has in this a tremendous advantage. Another great help in favor of the lodgepole is found in the early and more frequent seed production, whereby its seedlings are established earlier than the others. This factor plays an important part, particularly where the fire occurs in very young timber before the larch, etc., are old enough to bear seed.

Which of these species, larch or lodgepole, secures the upper hand depends, therefore, upon the frequency and intensity of the fires, larch holding out by virtue of its greater fire resistance and longevity, and lodgepole pine because of its copious seed production, seed preservation, and longer life of the seed itself.

SCIENTIFIC NOTES AND COMMENTS

What About Sites?

Roth's article, "Concerning Site," in Forestry Quarterly, Volume XIV, No. 1, brings up a very interesting query: Is our site quality II the equivalent of the European site quality II or III? Is our site III the equivalent of the European III or V? I will confess that my mind was cloudy on this point, rather inclining to consider our II like the European III and our III like the European V.

Roth compares the five site classes used in Germany with the three common in America with reference to the volume relation between the various classes. Giving site I a value of 100, he makes the point that the relative values of sites II and III in America correspond to those of sites II and III in Europe and not sites IV and V, as would be expected if the American site III was as inferior, compared with site I, as site V is in Germany.

This is certainly not the case for Norway pine (Chapman), in which site III has a relative value of 45, closely comparable to Schwappach's figure of 43 for site V Scotch pine.

Zon, to whom I referred my uncertainties, wrote, under date of July 10, 1916: "It seems to me that on the whole there is no doubt that our yield tables do not include site classes comparable to the German sites IV and V. This does not necessarily mean that our yield tables are incomplete, even for the whole range of the species, since the species may be entirely absent from less favorable sites than those given as III."

If this is the case, it follows that if our yield tables are really representative we must believe that we have no sites as poor as those classed IV and V in Europe. Does this seem reasonable?

Taking white pine, for example, Margolin's yield tables are based on stands in southern New Hampshire, where, as is well known, growth of this species is at its optimum. Conditions in Saratoga County, N. Y., and adjacent portions of the upper Hudson and Mohawk sand plains show white pine growing on sites which would certainly be classified as IV or V in Europe. Zon, in his letter, recognizes this and says: "Margolin's yield table for white pine in New Hampshire is probably not applicable to the Lake States' conditions, for the reason that site classes inferior to New England site III very likely exist in the Lake States."

In connection with Margolin's white-pine figures, Roth, in his article, says: "A classification by volume has been used . . . that the heights for the three sites vary so very little, is surprising and indicates the necessity of further field study." He then cites for stands 90 years old:

Site quality.	Volume, cu. ft. per acre.		Corresponding height: feet.	
	Roth.	Bul. 13.	Roth.	Bul. 13.[1]
I	12,700	14,000	97	108 (Table 3)
II	11,000	11,850	93	95.5 (Table 4)
III	9,200	9,750	89	83.0 (Table 5)

[1] U. S. Dept. of Agriculture.

This discrepancy is explained by the fact that the Bulletin 13 tables differ from the ones Roth cites in that the separation into quality classes is made *upon the basis of height* of the dominant trees *instead of that of the yield itself.* However, it still points to Margolin's tables as being equivalent to sites I, II, and III of the European tables and as ignoring sites IV and V (see figures in brackets in table, Forest Quarterly, XIV, 1, p. 12).

In the case case of Hanzlik's tables for Douglas fir (Forest Quarterly, XII, 3, pp. 440 ff.) a comparison with the latest tables for Norway spruce (Forest Quarterly, XII, 1, p. 114) shows:

Site quality.	Volume produced: Cubic feet per acre, at 60 years.		
	Norway spruce.	Douglas fir.	
		All trees.	Trees 12″ and over, d. b. h.
I	8,051	10,800	9,500
II	6,292	8,850	7,350
III	4,533	6,700	4,350
IV	2,789	.....	.....
V	1,287	.....	.....

This also points to an absence of sites IV and V in western Washington and Oregon.

Further field studies seem to be needed in order to determine whether or not we really have the equivalents of sites IV and V in this country. If we have them, they certainly should be recognized in our yield tables; if we do not have them, the fact that ours is a 5-qualities classification

which omits the lower two as non-existent should be made clear—or perhaps I should say clearer.

A. B. RECKNAGEL.

CORNELL FORESTRY CAMP,
AUGUST, 1916.

THE EFFECT OF WIND

The low relative humidity of the atmosphere in the central Rocky Mountain region is a matter of common knowledge. Its most common effect is seen in the "winter killing" of nearly all exotic perennials which have been brought into the region and which have not been given artificial watering. Many of these succeed admirably during the first summer, but succumb during the winter. This is also characteristic to a large extent of the seedlings of the native conifers, unless they are well protected by snow until they have produced a ligneous body. One of the few exotics which have given promise in this region is the Siberian larch, which, besides coming from a rigorous climate, gains protection by dropping its needles.

The winter winds of the region are always of much higher velocity than those during the growing season. The most persistent westerly anti-cyclones occur from January to March. East of the Continental Divide any such wind takes on the character of the Chinook, being warmed in its descent. It is only occasionally, however, that these winds are severe enough to cause visible injury to the native trees. Very marked injury was noted in the Black Hills region early in 1909; to a less extent in all of the foothills region of Wyoming and Colorado. This has not been repeated until 1916. During January and even earlier the winds were unusually severe. By the middle of February many trees showed winter killing. This was accentuated by further dry winds in March. The season was peculiarly lacking in snow until the first of April.

On a given site Douglas fir seems at first to suffer most severely, but later the yellow pine is seen to be more seriously damaged. Limber pine on the same site is very little affected and white fir not so much as Douglas. In nursery beds Engelmann spruce shows much less effect than Douglas fir; all of which is somewhat confusing, in view of the habitats ordinarily preferred by each of these species. But it is perfectly safe to assume that the higher the usual habitat of the species the greater the velocity of the wind to which it is adapted. Crown density may play a part in certain comparisons. The low resistance of yellow pine I can

only explain in connection with its high relative coefficient of non-available moisture. Tests so far made show this to be twice as great as with spruce and Douglas fir.

Any moderate case of winter killing in this region is not fatal. In fact, the death of trees from this cause seems to be rare. The retained foliage must be practically all "burned" before vitality is so reduced as to prevent the pushing out of new foliage. The effect on the tree seems to be identical, at least with yellow pine, with the effect of a grass fire.

That these winds have a decidedly detrimental effect on our forests, however, cannot be denied. During the present season the writer has had occasion to observe a large number of trees growing on a boulder-covered slope which produces an uneven stand and a great variety of site conditions. Some of the trees were very severely winter killed, while others, more fortunate in protection, showed no damage at all. This observation showed that practically every tree affected during the past winter has been affected before, resulting in under-development on the exposed (usually westerly) side of the tree and in the production of an asymmetrical and usually bent crown. Trees not affected during the past winter are in nearly all cases symmetrical, full crowned, and generally more healthy and vigorous. Sometimes the effect is confined to the tip of the crown, which has only become exposed as it overtopped its neighbors or a large boulder. Again, certain deflections of the wind may cause greatest damage at the base.

It is interesting to note that these persistent and sometimes violent winds of 1916 did almost no mechanical damage to trees except during a period of very cold weather in early February, when small twigs lost their usual elasticity and were broken.

The writer is forced to the conclusion that the poor quality of forests in this region is caused not so much by a general shortage of precipitation as by the desiccating effect of wind at times when the air becomes unusually dry and when soil moisture is cut off by freezing.

C. G. Bates.

Fremont Experiment Station,
July, 1916.

Silviculture and Grazing Combined

A unique method of handling pasture lands in the foothills is reported by Forest Ranger Douglas C. Ingram, from the Ochoco National Forest in Oregon. The method is of interest, since there are considerable areas of similar land in the Southwest—in Arizona, New Mexico, and in some

parts of Colorado. It consists of providing a larger forage area by trimming juniper trees (*Juniperus occidentalis*) of their lower limbs and hastening the production of post material at the same time.

The pasture, like many others in the foothills, has seriously decreased in carrying capacity, due to the encroachment of the juniper trees, and particularly to the shading out of the grasses by the lower limbs. While the value of this practice from a silvicultural standpoint might possibly be questioned, since the lower limbs, by shading the ground, doubtless conserve moisture which would otherwise be used by the tree, it is probably compensated by the increased height growth, due to the trimming of the lower branches. As there is an increasing demand for both pasture and post timber in the locality, the practice is worth while watching.

The work was done by one man at odd times while herding a small bunch of ewes and lambs. He was paid $30 per month with the understanding that he put in his spare time trimming up juniper trees when the sheep nooned or were grazed quietly. He was particularly instructed never to be out of sight of the sheep, but to leave them alone except when they attempted to get out of the pasture. The sheep were grazed freely over two sections, but were brought nightly to one bedding ground and corraled in a woven-wire enclosure. No attempt was made to trim the trees systematically—that is, to finish any particular area first—but, carrying his ax with him, the herder followed the sheep and whenever opportunity offered he trimmed a few trees, sometimes a dozen, sometimes only one in a place. It was more or less a side issue with the herder, and therefore it was difficult to get any estimate of the cost of his work. The man was in the pasture about a month—during part of May and June—and cut trees indiscriminately over the pasture, probably trimming trees on an area, all told, of about 200 acres. In the owner's opinion the herder made a profit above his wages on the sheep alone, due to his method of handling them; and the trimming of the trees was all profit. In any event, the owner plans to continue the work another year in much the same manner as done this spring, until all trees in his pasture have been pruned. It is the belief of the owner that, in addition to ultimately and materially increasing the carrying capacity of his pasture, the work done by his herder develops as much new forage as that actually consumed by his sheep while on the area. This is due, he claims, to the fact that where grass has not yet been completely shaded out by the growth of the lower limbs of the trees it is rarely obtained by grazing animals, on account of the prickles on the junipers. When the limbs are trimmed this grass becomes available for the grazing animals. Furthermore, sheep allowed to graze in the manner described probably eat less

of the grass species and more of the weed species not relished by cattle, thus providing food for both cattle and sheep. The pasture, when examined, showed no sign of damage as a result of this method of use and supported an excellent stand of grass, mainly *Agropyron spicatum*, *Bromus marginatus*, and Stipa (sp. ?). The pasture is noticeably free from weed species. The experiment is of interest also as an argument in opposition to the theory so generally accepted, that sheep and cattle cannot thrive on the same range.

Comparative Value of Burlap and Pine Needles as a Mulch

At the Pilgrim Creek Nursery, on the Shasta National Forest in northern California, an interesting experiment has recently been carried on to determine the relative merits of pine needles and burlap as mulch for seed beds. The species with which the experiments have been made are *Abies concolor*, *Pinus ponderosa*, *Pinus jeffreyi*, *Pinus lambertiana*, *Pseudotsuga taxifolia*, and *Libocedrus decurrens*. In carrying on the test 7-ounce burlap was used as a mulch on half of the beds, and on the others pine needles were applied to a depth of about 2½ inches.

The points upon which observations were made were: the number of days after sowing before germination started, the number of days to germinate 50 per cent of the total, the number of days before germination was completed, and the total per cent of the seed which germinated.

The results in nearly every case have been decidedly in favor of the burlap. Germination has started sooner, progressed faster, been completed in less time, and, except in the case of sugar pine, the total per cent has been greater.

An attempt was also made to compare the seedlings produced under the different conditions as to length of tops, length of root systems, character of the lateral root systems, and the general appearance of the plants. These have not pointed definitely to any conclusions, and in view of the difficulty of obtaining complete root systems when digging nursery stock and the empirical nature of the observations on character of the lateral root systems, and the general appearance of the plants, it is doubtful if much credence could be given to any conclusions which might have been drawn.

A Russian National Conservation Commission

Upon the initiative of the Russian Imperial Academy of Science of Petrograd, a commission has been appointed to investigate and report on

the natural resources of the Russian Empire with a view to their scientific and practical development and utilization. This commission is similar in its scope to the National Conservation Commission appointed by President Roosevelt. The war has brought forcibly home to the Russian people their economic dependence upon Germany and has quickened the nation's pride to ascertain the possibilities of its vast natural resources.

The commission in a surprisingly short time got to work—the first sitting took place only in October of last year—and is issuing a series of monographs, several of which have already been published, each written by a specialist.

REVIEWS

Seeding and Planting in the Practice of Forestry [1]

In the preface of this recent contribution to forest literature the author has explained the desirability of the need of a handbook on seeding and planting in forest practice applicable to conditions in the United States by stating that "with the exception of a few pamphlets widely scattered through the publications of the National Forest Service and the Forestry Departments of several States, and recent articles in the Forestry Quarterly and in the Proceedings of the Society of American Foresters, but little of trustworthy character dealing with this important subject has yet appeared in this country." Although the writer has stated that the manual is necessarily incomplete because the experience in the United States in this field is very limited, and that because this country presents such varied conditions of climate and soil the details of nursery practice, seeding, and planting must necessarily differ in one locality as compared with another, the book contains 443 pages of text matter, accompanied by 140 illustrations, in addition to an introduction of 13 pages. It is probably as complete as it is possible to make a manual at the present time. As the author states, the introduction is devoted to a discussion of the present condition of the forests of the United States, their economic importance, and the need for artificial regeneration.

Part I, following the introduction, deals with the "Silvical Basis for Seeding and Planting"; more particularly the principles which underlie the choice of species, the closeness of spacing, and the composition of the stand. Part II is descriptive of the various operations in artificial regeneration and the results that may be expected from the best practice. The table of contents is very full, which enables the reader to refer readily to any particular phase of the subject in which he is most interested. With one exception the Introduction and Part I can be passed over without much comment, since it is Part II which will be of most interest to the practitioner in forestry. In Part I the factors upon which the choice of species for artificial regeneration depends are listed by the author as follows:

(*a*) The closeness of the correlation between the site factors and the silvical requirements of the species.

[1] Prof. James W. Toumey, M. S., M. A., Director of the Forest School and Professor of Silviculture, Yale University.

(*b*) The suitability for the particular object in view.

(*c*) The adaptability for management under the required silvicultural system.

(*d*) The effect of the particular species upon the site.

(*e*) The cost of reproduction, rapidity of growth, and resistance to injury.

In addition, the author goes on to state that "in the selection of species attention should also be given to market requirements and economic utilization. Because of the expense involved in artificial reproduction and the length of time required to discover serious mistakes, one cannot afford to indulge in speculation as to which untried species may or may not succeed. In artificial restocking, from the point of view of financial results, one should confine himself to those species which actual experience has proved beyond doubt are acceptable for the object in view." This statement of the author is one which will doubtless find ready echo among the foresters of the U. S. Forest Service who, for a number of years, have tried out successively various exotic species, only to find that in the majority of cases the native species are far superior.

In Part II, "The Artificial Formation of Woods," the following general subjects are taken up: General Considerations, Forest Tree Seed and Seed Collecting, The Protection of Seeding and Planting Sites, Preliminary Treatment of Seeding and Planting Sites, Establishing Forests by Direct Seeding, The Forest Nursery, and Establishing Forests by Planting. These general subjects are, of course, subdivided a great many times. The book abounds in interesting statements and tables, and the author has drawn attention to those which he apparently considers the most important by the use of italics. Under the chapter "General Considerations," in discussing the initial cost for direct seeding as compared to planting, the point is brought out that in one particular series of operations *successful* restocking by direct seeding cost $20 per acre and *successful* restocking by planting $12.50. The author goes on to state, however, that "the extremely high percentage of failures from direct seeding in the United States should not condemn the method, but rather warn against its use except on sites and under conditions that give reasonable hope of success." And, further, that "it is the frequency of failures that makes the average cost of successful reforestation by direct seeding high in this country."

Under the subject, "The Origin of the Seed in Relation to Quality," the statement is made that "we do not adequately appreciate the great importance attached to the source from which forest tree seed is obtained. The common practice of collecting seed from trees exhibiting all degrees

of inherent defects and from all localities within the tree's range is condemned. Although trees of extreme youth and old age may yield excellent seed, it is uniformly of the highest quality when collected from vigorous trees in middle life. The age of the parent tree is not so important a factor as is its condition resulting from climate, soil, and inherent defects. For many years there has been a diversity of opinion among foresters regarding the influence of the locality and the characteristics of the mother tree upon the resulting crop. Recent investigations in Europe clearly prove that variations in the characteristics of the mother tree, due to soil and climate, may be transmitted through the seed." This preceding statement is becoming more and more recognized by foresters in America, and in the collection of seed consideration is given to the facts stated therein whenever possible. The principal difficulty in the past has been that, due to the expense involved in collecting seed only from certain localities, it has been more practical to collect where it could most easily be secured.

Under the subject of "Forest Tree Seed and Seed Collecting," a number of very interesting tables are presented, such as the variation in size of forest tree seed, number of seed per pound of different species, the cost of collecting, the amount of clean seed per bushel of cones, the percentage of purity in tree seed, and the average viability of commercial seed. Such information is often wanted and it is well to have it presented in a publication which is easily available. An interesting experiment is one which brings out the fact that a large percentage of seed that appears good under ocular examination fails to grow when subjected to the germination test. In this experiment, conducted with 40 species and extending over 10 years, results were obtained which appeared much higher than those later obtained from germination tests. With the broad-leaved, large-seeded species, such as walnut, oak, hickory, maple, and ash, the results from the cutting tests compared most favorably with those obtained later by germination tests, but even here they were much too high. The ocular examination of the seed of coniferous species and small-seeded, broad-leaved species gives results that are often 50 per cent higher than those obtained from germination tests. A great number of the paragraphs are exceedingly interesting, but space will not permit mention of more than a few of them.

In the one relating to methods of storing seed the writer has stated that the method best adapted to a given species does not deviate to a marked degree from that of natural preservation of the seed up to the time of its germination. Thus he points out that from Zederbauer's experiments it appears that seed which matures in the autumn and is dis-

seminated at once and covered with leaves after it falls to the ground is favored by conditions which afford low temperature and high humidity. Seed which matures in the autumn, but is retained on the trees over winter, is exposed to low temperature and normal atmospheric humidity. When stored it appears to be favorably affected by low temperature, but not by excessive moisture. He calls attention to the fact that Cieslar found that the germinative capacity of acorns is best preserved by storage at low temperature and a high degree of humidity, while the temperature and moisture conditions in the ordinary cellar, warehouse, or heated room are very unfavorable. The experiments of Haack, here also quoted, conclusively prove the favorable influence of uniform temperature and the exclusion of air for pine, spruce, and other seeds that permit of storage in dried condition. For all species that will withstand thorough air-drying without injury it affords the best possible mode of storage. Thus Haack found that the seed of Scotch pine stored in this manner for two or three years produced from 1.6 to 3.3 times the number of plants obtained from samples of the same lot of seed stored in the open air under the most favorable conditions.

A paragraph is given about the method followed by Eastman in the storage and successful germination of red cedar. Since the germination of this species of seed has been a stumbling-block to many who have attempted its growth, this discussion will be of especial interest. This method was followed by Eastman with uniform success for several years. The fruit is gathered from October to January and immediately stratified. without previous treatment, such as soaking or the removal of the seed from the fruit. It is placed in ordinary gardener's flats. A layer of sand 1 inch in depth is put into the flat, then a layer of fruit one-half inch in depth, this being repeated until the flats are filled. They are then buried in the ground so that the tops are slightly above the surface. Over them is placed about 8 inches of leaves or other litter, weighted down with stones. They are left undisturbed until a year from the following March, when the seed is removed from the sand and sown in the nursery. The beds must be made very early, as the seed begins to germinate during the first warm days of spring.

Professor Toumey's observations upon the effect of preparation of soil upon young trees is interesting. After stating that young plants make much more rapid growth on plowed land and the loss during the first few years is less, he goes on to say that whether this is always of advantage is a debatable question, since in some cases it appears to be followed by evil effects, particularly where the trees are closely spaced. Thus white pine planted in plowed fields on first-quality sites usually grows rapidly

and evenly. As the canopy closes, the intensity of the competition causes all the trees to suffer alike, and the ultimate result is very disastrous unless thinning is begun very early. On the other hand, when the trees are set on unplowed land, the young trees from the first show considerable variation in height growth; and, as a result, when the canopy closes the competition is not so intense and early thinnings are not so essential.

The question of the location of a nursery is very often a perplexing one, particularly when it has to supply stock for a wide altitudinal range of country. In this connection the author has stated that a moderate difference in the altitude of the nursery as compared with the planting site, even a difference of one or two thousand feet, should not ordinarily necessitate the establishment of separate nurseries, unless there is a well-marked difference in the vegetation. He emphasizes the fact, however, that it is important for the nursery to be established at the lowest elevation in the forest over which the stock is used, because it is more accessible, stock of suitable size can be grown in shorter time and at less cost, work can begin earlier in the season, and there is much less danger of frost injury.

In one paragraph the author has expressed the belief that transplant conifers are used far more extensively than is necessary, and that in many localities where we are now using transplant stock, robust seedlings, which can be produced at less than half the cost, can be used with equal success. It is hoped very much that the author is correct in his belief, since it will make possible the conducting of reforestation operations over much larger areas than has been the case in the past simply because of the lesser cost of seedling stock.

The chapter upon "Establishing Forests by Planting" contains some of the most useful information in the book. In it particularly good discussions are made of the following points in regard to planting rules:

(*a*) The trees should be planted so that the roots reach to a greater depth than that attained by the downward desiccation of the soil during summer droughts.

(*b*) With due allowance for the settling of the soil, the collar of the tree should occupy the same position in reference to the surface soil that it did in its original position in the nursery.

(*c*) The root system should be given, so far as practicable, its natural position in the soil, and the roots should not be crowded together, bent to one side, or placed in a single vertical plane.

(*d*) When the site is overwet, due to free water near the surface or other causes, the trees should be planted above the general level of the surrounding soil, viz., on mounds or ridges.

(*e*) When the site is overdry, due to soil or climatic conditions, the trees should be planted below the general level of the surface soil, viz., in pits or trenches, so that they can make greater use of the lower soil water.

(*f*) Only the best and the freshest soil should come in contact with the roots in filling in about the trees.

(*g*) In planting on steep slopes a step-like niche should be made and the plant set deep in the niche. The soil removed in making the niche should be placed on the lower side of the opening.

(*h*) One plant should usually be set in a planting hole. Under special conditions two or more coniferous plants are planted together. When such is the case the plants should be small.

(*i*) The stem should usually be given an erect position and the soil thoroughly firmed about the roots. In planting for soil protection the plants are sometimes placed oblique.

(*j*) The smaller the planting material, the less expensive and the quicker and more certain the results, provided the trees are able to survive the planting operation.

(*k*) The pruning of coniferous stock should usually be restricted to cutting back the longer roots. Broad-leaved species require the pruning back of the longer roots and the reforming of the crown when ill-shaped.

The author has forestalled the chief criticism that can be made of the handbook when he states, "although the author appreciates that criticism is invited by the description of many methods and tools not used in the United States, he believes that they should be known where experience has fully demonstrated their usefulness elsewhere, and there is a possibility that they may be used advantageously under special conditions in this country." In going through the book the reader is struck by the great number of methods described and also by the liberality with which the author has drawn upon European literature for his subject-matter. This tends to expand the subject-matter more than seems desirable in some cases. Since, as he has stated, however, there are only a very few publications in the United States upon this subject, his continual reference to European literature is undoubtedly justified. The placing of the results obtained by European investigators in an English publication undoubtedly makes them much more available for the American public than they are in the original publications.

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Looking from the standpoint of the forest practitioner only, who is more interested in specific rules to guide his procedure than in the reasons

for it, Part I, dealing with the "Silvical Basis for Seeding and Planting" may appear superfluous. Yet to the research worker and the pioneer forester, who is just beginning to orientate in the great variety of conditions under which he must work, it is this part of Professor Toumey's book that will be most welcome. There are a number of books in German, such, for instance, as Fürst's book, "Die Pflanzenzucht im Walde," and others, which discuss very much in detail the various phases of nursery practice, sowing, and planting; yet what distinguishes Toumey's book from such manuals is the new viewpoint, the silvical basis for planting operations, which raises the forestation practice from mere empiricism to a higher level of scientific reasoning.

One of the most critical questions with which most of the foresters, charged with planting work on the National Forests, meet is the proper selection of planting sites—what species and stock to plant on a given site. The success or failure of the planting in many cases depends upon the proper decision whether the site is suitable for white pine, yellow pine, Douglas fir, or any other species. When there is some natural reproduction already on the ground, the forester may be guided by this natural indication. In most cases, however, it is only the topography, exposure, altitude, and the herbaceous vegetation that must guide him in determining the species to plant. Without a thorough knowledge of the physical and climatic differences of sites, the forester can never expect to solve intelligently this question of planting sites. As an illustration of the need of basic silvical information for successful forestation work may be cited the following case: There has recently been an urgent demand for raising a large number of western red-cedar seedlings at one of the National Forest nurseries, and it is only by understanding the behavior of natural reproduction of the western red cedar that enabled the man in charge of the nursery to cope successfully with the problem of how deep to sow the seed, what cover to use, what shade to give to the young seedlings, etc.

Artificial reproduction, just as natural reproduction, involves a knowledge of the relation of the plant to its environment. There is this difference, however, between natural and artificial reproduction: in the former case the physical factors affecting reproduction, such as soil, moisture, etc., are largely beyond human control, while in the latter case man can create to a large extent the desired environment for the production of plants; and even when the plants, after leaving the nursery or transplant bed, are set out in the permanent site, man can produce the kind of stock which will be most adapted to the environment in which it is to exist and

grow. Although there is this wide difference in the practical methods of securing natural and artificial reproduction, from the research standpoint the two supplement each other. Studies of reproduction of a certain species under natural conditions will point to definite methods for handling it in the nursery, and likewise methods which prove most successful in raising a certain species in the seed-bed may throw light upon its requirements under natural conditions.

While in studies of natural reproduction the most available method is that of observation—the actual field of experimentation being comparatively small—in the study of artificial reproduction the field for experimentation is exceedingly wide; and this again brings out the value of studies of natural reproduction as supplementary to a clearer understanding of artificial reproduction. The basis of nearly all studies of artificial reproduction is the relation of seed or plant to heat, moisture, light, and fertility of the soil. Ability to measure these factors and interpret them in the terms of the life of the plant is therefore as essential in artificial reproduction as in natural reproduction and other problems where the measurement of physical environment is involved.

By bringing out this relationship between basic silvical knowledge and what seems to be a very practical procedure of raising stock and planting, Professor Toumey rendered a real service for our reforestation work in this country.

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THE VEGETATION OF A DESERT MOUNTAIN RANGE [1]

A recent publication by Shreve, "The Vegetation of a Desert Mountain Range as Conditioned by Climatic Factors," should prove of more than usual interest to forest ecologists.

The study was made in the Santa Catalina Mountains, near Tucson, Arizona. The altitudinal range of the region covered is from about 3,000 to 9,150 feet. A series of three main vegetational types is considered, namely, the Desert, the Encinal or Woodland, and the Forest. The Desert is considered as extending to an altitude of about 4,000 feet on north slopes and 4,500 feet on south slopes. The vegetation is characterized by a predominance of microphyllous trees and shrubs and an abun-

[1] Shreve, Forrest. "The Vegetation of a Desert Mountain Range as Conditioned by Climatic Factors." Carnegie Institution, Publication No. 217.

dance of cacti. Conspicuous among the latter is the giant cactus (*Carnegiea gigantea*). The Encinal or Woodland type extends from the Desert to about 6,300 feet on south slopes and 5,800 feet on north slopes. This type is characterized by an open stand of evergreen oaks, juniper, and piñon. The Forest extends from the upper limit of the Encinal to the top of the highest peak, 9,150 feet. It is divided into the pine and the fir forests. In the former the predominant species is yellow pine (*Pinus arizonica*); in the latter, Douglas fir (*Pseudotsuga mucronata*), Mexican white pine (*Pinus strobiformis*), and white fir (*Abies concolor*) are predominant. Yellow pine occupies all of the south slopes to the summit. The fir forest occupies north slopes above 7,500 feet. Engelmann spruce evidently does not occur even at the highest altitudes.

A valuable feature of the publication is a complete flora of the Santa Catalina Mountains, arranged by vegetational types and also by families in alphabetical order.

The discussion of climate is very exhaustive. Conditions in the Santa Catalina region are generally similar to those in the entire Southwest. The characteristic features are a great diurnal range in temperature and very marked seasonal variations in moisture. Records of precipitation, evaporation, soil moisture, and temperature have been maintained at a series of stations located at 1,000-foot intervals from 3,000 to 9,000 feet. On account of the physical difficulties attending the maintaining of records at high altitudes, these records are somewhat fragmentary. Although Shreve has by ingenious methods of interpolation bridged the gaps with remarkable success, the reader is repeatedly impressed with the general need for more complete records of this character.

The complex of moisture factors, embodying precipitation, evaporation, soil moisture, and humidity, is probably the most important element in determining the distribution of vegetation in the Southwest. The seasonal distribution of precipitation at Tucson, as determined by a record of 38 years, is as follows: "Humid winter," 31.1 per cent; "arid fore-summer," 5.9 per cent; "humid midsummer," 50.6; "arid after-summer," 12.4 per cent. The mean annual precipitation at Tucson is about 11 inches. The two rainy seasons yield 81.7 per cent of the moisture. The remainder, which falls in the two arid seasons, usually comes in such small quantities as to be of no value to vegetation. The distribution varies greatly from year to year. In 1881 the summer rainfall was 80.3 per cent of the total, while in 1884 it fell to 11.7 per cent. A comparison of seasonal distribution of precipitation at a series of stations from the Pacific coast eastward to the Rio Grande shows the relation between summer and winter rainfall to be completely reversed. Thus on the Pa-

cific coast 75 per cent comes during the winter months, while at the Rio Grande, in New Mexico, it is only 20 per cent.

With respect to water relations, conditions are, as is well known, much more favorable in the high altitudes than in the lower altitudes. Records for eight years show that the average summer precipitation at 8,000 feet is 2.4 times as great as at 3,000 feet. Not only is there a marked increase of precipitation, with increased altitude, but the intensity of evaporation and the length of the "arid foresummer" are decreased. On the desert the length of the "arid foresummer" is 15 weeks; at 6,000 feet it is 11 weeks, and at 8,000 feet only 6 weeks.

The seasonal and altitudinal variations in precipitation are, as is to be expected, reflected in soil moisture. A significant feature of the moisture determinations during the "arid foresummer" is the fact that there is no appreciable increase of soil moisture up to an elevation of 7,000 feet. Beyond this elevation there is a sharp rise, particularly on north slopes. This indicates that, as far as superficial moisture conditions are concerned, the "arid foresummer" carries the desert up to the lower limit of the pine forest.

With respect to evaporation, there is less differentiation between desert and forest in the summer rainy season than during the arid portion of the summer, indicating that during the summer rainy season the two types approach each other more nearly than at any other season. There is a pronounced drop in evaporation from 7,000 to 8,000 feet. This corresponds with soil moisture conditions, and, as the former elevation indicates the lower limit of the pine forest, the inference is that the forest exercises an appreciable influence in retarding evaporation. The summer evaporation on the desert is 3½ times as great as at 8,000 feet.

A notable advance in the study of moisture conditions is the use of ratio of evaporation to soil-moisture content.

$$\frac{\text{Evaporation (cc. per day)}}{\text{Soil moisture (per cent of dry weight)}}$$

This ratio, together with the duration of the "arid foresummer," gives a concise expression of all moisture factors. At 3,000 feet the ratio is 50.5 and the duration of the "arid foresummer" 16 weeks, while at 8,000 feet the ratio is 2.6 and the duration of the "arid foresummer" is 7 weeks. In this connection it is worthy of note that Fuller[2] has gone a step farther by adopting the ratio of evaporation to growth water.

Temperature records show the usual decrease with an increase of eleva-

[2] Fuller, George D. "Evaporation and Soil Moisture in Relation to Succession of Plant Associations." Botanical Gazette, 58: 193-224. 1914.

tion. The gradient established for the Santa Catalinas is 4.11° F. per 1,000 feet. Hann's[3] figure for Pikes Peak is 3.46° per 1,000 feet, and for the Sierra Nevadas (Colfax, Placer County) 4.12° per 1,000 feet. The free-air gradient is placed at 2.2° to 2.5° per 1,000 feet. It is shown that the gradient for different elevations in the Santa Catalinas is by no means uniform, due, apparently, to the influence of topographic features. There is a negative gradient between the Desert Laboratory (2,663 feet) and the 4,000-foot stations. Between 4,000 and 5,000 feet the gradient is at the rate of 10° for 1,000 feet. Comparisons of minimum temperature in the Santa Catalinas, the Pinaleno (Graham) Mountain, and stations in northern Arizona indicate that "all phases of winter temperature conditions are less severe on small and isolated desert mountains than on the plateaus and highlands of the same elevations and of nearly the same latitude."

Very striking differences in temperature due to cold-air drainage are recorded. These observations are in close accord with those made by the reviewer at the Fort Valley Experiment Station.[4] During one month (May) the mean minimum temperature in the Santa Cruz Valley was 17.8° lower than at the Desert Laboratory, situated on a hillside 335 feet above. Canyon bottoms have been observed to register lower minima in clear, dry weather than the rim 1,000 feet higher; but in cloudy weather or immediately after rains the relation is reversed, showing the normal temperature conditions to be expected from the influence of altitude alone. A heavy forest cover has been found to retard cold-air drainage. In Marshall Gulch, heavily timbered with fir, the temperature on the rim was 10° lower than on the floor of the canyon during the winter period and 18° lower during the period from May 18 to July 24. From his experiments in the Santa Catalinas and extensive observations in other localities, Shreve concludes that "the elimination of cold-air drainage by a forest cover can take place only in small mountains which are forested to the summit. A large mountain mass, an extremely steep mountain side, or an extensive area lying above timber-line will cause a flow of cold air down through the forested areas below. This is exemplified at the San Francisco Peaks, Arizona." Experiments at the Fort Valley Experiment Station may throw additional light upon this phenomenon. Fort Valley, a flat, treeless valley or "park," about 1½ miles wide, situated at the base of the San Francisco peaks, shows evidence of strong cold-air drainage. The minimum temperature in the valley is often 15° F. lower

[3] Hann, J. Handbook of Climatology. Translation by R. De C. Ward. Pages 242-246. New York, 1903.

[4] "A Meteorological Study of Parks and Timbered Areas." Monthly Weather Review, Vol. 41, pp. 1615-1629. 1914.

than in the surrounding pine forest. Undoubtedly, a portion of this difference may be accounted for by the effect of the forest in checking radiation. The valley is also slightly lower than the surrounding forest, although both valley and forest lie in a large basin. There is a very strong indication that the forest here tends to deflect the cold-air currents, causing them to pass over the tree-tops. Thus, while cold-air drainage is not checked, it is retarded within the forest, but not in the open valley.

Shreve cites a striking correlation of topography with the action of cold-air drainage in the observation that individuals of a species reach their highest altitudinal limit on ridges and never in the bottoms of canyons. Although, as pointed out later, this phenomenon is due mainly to the fact that ridges receive the greatest amount of insolation, cold-air drainage undoubtedly is an important factor.

One of the most valuable applications of temperature data in Shreve's work is the determination of the frostless period. The length of this period at the Desert Laboratory (2,663 feet) is 282 days; at 5,000 feet it is 248 days; at 7,000 feet, 187 days; at 7,600 feet, 148 days, and at 9,000 feet, 122 days.

The chapter which is of greatest interest to foresters is the one entitled "Correlation of Vegetation and Climate." The object, as stated by the author, is "to correlate, in so far as possible, the altitudinal changes of vegetation and climate, in an effort to determine roughly some of the physical factors which are of critical importance in limiting the vertical ranges of the types of vegetation and of their characteristic species." Similar investigations are being carried on in several of the districts of the Forest Service. In the investigations undertaken by the Forest Service an effort is being made to secure fairly continuous records for all altitudes. This should make it possible to go further than Shreve has done in determining the limiting factors in the distribution of plants, particularly forest trees.

Shreve shows that although the vertical range of several species is over 4,000 feet, none of the native plants in the Santa Catalinas are capable of accommodating themselves to the entire range of physical conditions encountered from the desert to the forest. "The species which exhibit the widest belts of vertical distribution are to be found in the most dissimilar habitats at the lower and upper edges of their ranges, which indicates that these species are not really capable of existence through 2,000 or 3,000 vertical feet of climatic gradient under the same conditions of topographic location, slope exposure, and insolation. In fact, a close analysis of the habitats occupied by characteristic plants, in connection with their vertical ranges, indicates that below 6,000 or 7,000 feet no

plants outside the desert succulents and semi-succulents range through more than 1,000 to 1,500 feet in habitats of the same topographic character. At higher elevations a number of common plants extend more than 1,500 feet in situations of the same character, as, for example, *Pinus arizonica,* which ranges through nearly twice that altitude on dry southern slopes" (page 89).

It is a peculiar circumstance that *Pinus chihuahuana* is observed to occur very rarely on north slopes. Even its lowest occurrences are on south slopes or on an approximate level.

The shortening of the growing season with an increase of altitude and the concomitant lowering of temperatures of this season are regarded as factors of great moment to the vegetation; but no work has been done to establish the precise temperature and temperature-duration requirements of any species of plants.

The temperature conditions of winter are considered equally important with those of summer. Among the phases of winter temperature considered are the length of the period subject to frost, the number of days with freezing temperature, the number of consecutive days or hours of freezing, and the absolute minimum reached. In those cases in which plants are killed by the action of low temperature, the most important factor to be considered is the actual duration of the period during which the plant is subjected to a temperature below 32°. Secondary to this are the considerations of the amount of precooling received by the plant, the actual minimum temperature to which it was taken, the condition of the soil and atmosphere during the freezing, and the nature of the weather subsequent to it" (page 95).

Experimental work by Shreve has shown that more than 18 consecutive hours of freezing temperature is fatal to *Carnegiea* (giant cactus). *Opuntia versicolor* and *Echinocereus polyacanthos* are able to withstand 66 hours of continuous freezing temperature. He considers this a very potent factor in determining the upper limits of the occurrence of plants (page 96).

The influence of aspect is found to be much stronger at high than at low elevations (page 98). In the desert and woodlands the uppermost limits of a species on north and south slopes are from 600 to 1,000 feet apart, while in the forest region the upper limits of the same species on opposed slopes differ by 1,000 to 2,000 feet. This is in harmony with the finding of a steeper gradient of climatic changes in the higher altitudes.

The universal occurrence of a large number of species, their commonness within their ranges, the consistency of their distribution with respect to slope exposure, and the fact that thousands of years have already given

an opportunity for possible extensions of range are cited as evidence that all the species in the Santa Catalinas have attained as wide a range as it is possible for them to have under existing climatic conditions. "The present vertical limit of a species, whether upper or lower, must be looked upon as the average point at which some particular feature of its physiological activities is met by some particular environmental condition that is preventive or unduly inhibitory to it. The minor fluctuations of climate, which have their minimal and maximal values within periods that are as brief as the normal life of a perennial plant, are registered in the infrequency of every species as it approaches its distributional limit and in the scattered individuals which lie farthest out from the main area of occurrence. The secular changes of climate which have their maximal and minimal points many centuries apart are registered in slight movements of the limits of species, the marginal region of scattered occurrence being, of course, the first affected by such movements."

Shreve finds no evidence to indicate that competition is responsible for the limitations of the distribution of any species in the Santa Catalinas (page 100). This finding is in direct opposition to the theory occasionally advanced in the Forest Service, that the range of certain forest trees is limited by competition with other species. For example, the statement is sometimes made that the reason western yellow pine does not occur in the subalpine or Engelmann spruce types is that it cannot compete for light with such species as white fir and Engelmann spruce, and that therefore western yellow pine could be successfully introduced into higher types by planting, where the other species have been eliminated. The evidence cited by Shreve, together with personal observations, lead the reviewer to regard the theory advanced by certain foresters as unsound.

The effects of slope exposure and altitude upon physical factors are such that it is possible to find on a south exposure at a certain elevation almost the same complex of environmental conditions as on a north exposure at a lower elevation. Measurements of evaporation throughout the range of *Pinus cembroides* show a close correlation for different altitudes and exposures. The curves for 5,000 feet on a north slope, average of north and south slopes at 6,000 feet, and 7,000 feet on a south slope run parallel, and, except for the 5,000-foot curve during the arid dry season, they almost coincide. The ratios of soil moisture to evaporation for the above situations are 21.3, 24.5, and 24.1, respectively.

The general effort of canyons and streams is to carry plants below their normal range, while the effect of ridges is to carry them above the normal range. In the former instance moisture is regarded as the controlling

factor. The upward extension of plant ranges on ridges is attributed to an increase in the total amount of solar radiation on ridges as compared with adjacent flats or slopes.

The following extracts from Shreve's "General Conclusions" are particularly worthy of note:

"The sensitiveness which desert vegetation exhibits to slight environmental differences is even more pronounced with respect to the climatic gradients of the mountains. Throughout a vertical range of 6,000 feet there is not only a very striking gradient of vegetation, but a very nice adjustment of vegetation to the physical conditions. In the Desert and Encinal regions, and to a great extent in the Forest as well, this is chiefly an adjustment of plant to environment and scarcely at all an adjustment of plant to plant. Every juvenile individual in the open Desert and Encinal regions is a pioneer, and on reaching maturity this individual is part of an ultimate stable community.

"The principal features of altitudinal climatic changes are: The shortening of the frostless season, the lowering of the daily curve of temperature throughout the frostless season, the increasing of the intensity and duration of all critical phases of low temperature during the frost season, the shortening of the arid foresummer (the critical season of aridity), the increasing of precipitation and therefore of soil moisture, and the decreasing of evaporation.

"It is impossible to study the distribution of vegetation in a region where pronounced differences may be found within short distances without being impressed with the independence which each species exhibits in its allocation. Plants which are associated on the Lower Desert Slopes, for example, range to very different maximum altitudes, and plants which are associated in the Upper Encinal are found to be in part at the upper edges of their ranges, in part at the lower edges, and also in part rather closely restricted to that region. It is nowhere possible to pick out a group of plants which may be thought of as associates without being able to find other localities in which the association has been dissolved. Certain plants may be thought of as having closely identical physical requirements because of their associated occurrence in the same spot. Nevertheless, the fact that the vertical ranges and habitat characteristics of these species will reveal more or less pronounced differences goes to show that each of them has survived in a particular section of the climatic gradient. It is true in the Santa Catalina Mountains, as it is true in all other places, that the associated members of a plant community are not able to follow each other to a common geographical and habital limit. The physical requirements of plants are so varied and so elastic that the composition of a series of communities occupying similar habitats in widely separated places shows the constant overlapping of the ranges of individual species which is due to the physiological inequivalence of these species.

"It is particularly true of the plant communities of arid and semi-arid regions that the most closely associated individuals are not alike in their

life requirements, and this is true to a less pronounced extent in all plant communities. The members of the many diverse biological types, or growth forms, which are found together in Desert and Encinal find their soil water at different levels, procure it at different seasons, and lose it through dissimilar foliar organs, at the same time that they react differently to the same temperature conditions. In brief, these associated plants are not living in the same climate, but are living in different sections of the same climate, the demarcation of these sections being either temporal or spatial."

It is impossible in a few pages to adequately treat so comprehensive a work as the one which is here reviewed. Foresters who are interested in the relation of plant distribution to climatic factors, and especially those who are investigating these problems, will find Shreve's book full of valuable information and suggestions.

G. A. PEARSON.

FORT VALLEY EXPERIMENT STATION,
JULY, 1916.

PHILIPPINE DIPTEROCARP FORESTS

Brown and Matthews[1] have published a valuable contribution to our knowledge of the dipterocarp forests of the Philippines. It is pointed out in the introduction to this paper that while it has been generally known that the dipterocarp forests are the most extensive and important forests of the Indo-Malayan region, yet little has been known concerning the factors influencing their growth and development, without which knowledge it is well-nigh impossible to handle them according to rational silvicultural practice.

The dipterocarp forests are characteristic of the area below 3,000 feet altitude of the moister portions of the Indo-Malayan region. They extend from northern India through Ceylon, Burma, Indo-China, Malay Peninsula, Sumatra to Java, Borneo, and the Philippines. The name "dipterocarp" is an abbreviation of the family Dipterocarpaceæ, one which is confined almost entirely to the tropical regions of southeastern Asia and adjacent islands. They usually occur on the best soil sites, and for that reason in the thickly populated regions have almost entirely disappeared to make way for agricultural crops.

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[1] Brown, W. H., and Matthews, D. M. Philippine Dipterocarp Forests. The Philippine Journal of Science, Sec. A, Chemical and Geological Science and the Industries, Vol. IX, pp. 413-516; 49 tables; 12 text figures; 13 plates; 1 map. Published by the Bureau of Science of the Philippine Government, Manila, P. I., 1914.

In the Philippines there are approximately 40,000 square miles of virgin forests, three-fourths of which consist of dipterocarp forests. In these forests 75 per cent of the merchantable standing timber is composed of members of this family. The large size of the trees, the density of the stand, the character of the wood for general construction and finishing work of all kinds make the forest an important one for the investment of capital. While the woods are classified as "hard woods," a large proportion of the cut is sufficiently soft to be suitable for the same general construction work for which the conifers of the temperate regions are utilized. A smaller proportion of the wood of this family in hardness and use is comparable to the oaks. Indeed, the family as a whole bears the same economic relation to the regions in which it grows as the conifers and oaks do to the temperate regions.

The authors have confined their studies of growth and environmental factors to four selected forest areas. These areas are typical of the different forms of the dipterocarp type.

The first of these areas, found in northern Negros, carries a forest that has an overmature stand that is well balanced between growth and decay, with the canopy and bulk of the stand concentrated in the largest-size classes. The shade is too dense to permit the development of an evenly graded understory which could be counted on to reproduce the forest and fill up the blanks made by the removal of the mature and overmature classes. The silvicultural problem is to remove in the shortest rotation possible the large amount of accumulated wood capital which is not producing, but *which is an integral part of the forest.* Its removal is thus likely to endanger the very existence of the forest.

The second form of forest, found in the province of Bataan, is more complex in character than the Negros forest. Due to rougher topography and to a more pronounced dry season, this forest has a canopy that is less dense. Consequently in composition the forest is more complex; the dipterocarps, while forming the bulk of the stand, do not constitute as large a proportion of it as they do in the Negros forest. There are, however, patches in the forest where the situation is favorable for the development of dipterocarps, which show the same overmature even-aged development as is found throughout the Negros forest. Otherwise the forest contains smaller-sized dipterocarps, and there are a larger number of species other than dipterocarps that when mature form, with the dipterocarps, the upper story. Also, due to the poorer development of the main story, the forest has produced well-developed second and third stories and the undergrowth is, as a rule, denser. Since the companies operating in this forest desire to utilize the dipterocarps mainly, the problem pre-

sented here is the removal of the mature and overmature stand within as short a time as possible and obtaining reproduction with dipterocarps as the leading species under a shelter wood, which will be made up of species other than dipterocarps. If the companies are compelled by rational management to leave any timber on the ground, they much prefer to leave those other than dipterocarps. If successful utilization is thus taken into account, the management must look as much to dipterocarp seedlings and poles already on the ground for reproduction as to dipterocarp seeds that may be sown in the area from the overmature seed trees which it is possible to leave in the remaining stand.

The third form of forest, found in the northern part of Laguna Province, is situated on a plateau about 1,000 to 2,000 feet above sea-level. The forest is very distinctly dipterocarp throughout the whole region. Contrasted with those regions previously discussed, this forest is composed of smaller-sized trees and is not overmature. Each species in the area is represented more by trees of the smaller diameter classes than by large overmature specimens. The main canopy is even more open and irregular than the better parts of the forest of Bataan, and this has resulted in a very well-developed lower story and dense undergrowth, the latter being made up almost entirely of tree seedlings of dipterocarps. From the management standpoint, this forest approaches as nearly the ideal, in regard to composition and the distribution of volume throughout the different-size classes, as could be expected of any forest in the Philippines. Thus the forest is suited to the selection system of management, which is the system most suited to forests in which the species are tolerant in youth and later develop into large distinctly intolerant trees. It is one of the few in the Philippines which could be satisfactorily managed with a diameter limit as the sole regulation.

The fourth form of dipterocarp forests considered by the authors is found on the slopes of Mount Maquiling, in the province of Laguna. It has been subjected to selective logging for many years. The most valuable commercial trees at the lower elevation have been almost entirely removed. This has favored the species which could normally exist in the understory to such an extent that they occupy the dominant situation at first held by the dipterocarps. Such species have thus increased in numbers. The most accessible portions of the forest are those extending from one-half to one and a half miles from the edge up to elevations of 700 feet. By heavy logging the main canopy has almost entirely disappeared, thus allowing the entrance of light, which has permitted the invasion of a jungle growth of bamboo, rattan, and vines of various kinds. Higher up the mountain, where the logging has been less intense, the original

forest has not been so seriously changed. There is evidence to show that the original forest on the lower slopes of the mountain was dipterocarp in nature. It has been already drained of its valuable species and will not return to its original condition within any reasonable length of time. The portion higher up, in which dipterocarp seedlings and saplings are fairly represented, will return to its original condition in a much shorter time. The management problem is to remove a portion of what constitutes the present dominant story, in such a manner that the dipterocarps will have a better chance to develop, since there is practically no market for the trees which constitute the present canopy. Unless a market is developed for them, costly girdling and cleaning operations would have to be resorted to.

The conclusions on the character of the above forest "forms" are derived from tables showing the diameter and volume of selected areas, etc.

The next series of headings deal with the invasion of vegetation on lands cleared for raising crops and then abandoned and those logged over. In the former case the cleared land usually passes either to second-growth forest or to grass land, the latter due to repeated fires. On cut-over lands, so far as observed, the invasion vegetation is second-growth forest. The forest consists of short-lived trees of one or more species of little value from a commercial standpoint and in development becomes more and more complex. If such a forest is situated far from the original forest, it is from the standpoint of management a permanent type. Even if near an original seed forest, the time it will take to recover its original condition is so long that unless planting operations are invoked it is of little importance from the standpoint of practical forestry. In other words, cutting operations carried on at the present time destroy completely the original forests.

The greater part of the paper is devoted to growth measurements. Here a mass of information has been collected that shows the growth in diameter of a large number of individual trees, mostly dipterocarps in different environmental conditions, and brings forward some striking conclusions. All these conclusions cannot be discussed in a review of this nature, and attention will be called to a few of them. The most striking measurements are plotted and compared with the growth of species of temperate climates. One of these tables shows that it takes a dipterocarp species (*Parashorea plicata*) growing in the dense forest 120 years to attain a diameter of 12 inches, while yellow-poplar trees growing in the hardwood region of Virginia, Kentucky, and Tennessee in the same time attain the same diameter in 68 years. However, it takes 115 years for yellow poplar to grow from 12 inches to 28 inches in diameter, while the dipterocarp makes the same growth in 50 years.

The conclusion drawn from these and other like measurements on different species is that the slow growth of the dipterocarp is referred largely to the lack of light under the main canopy of the forest. The yellow-poplar measurements were taken in the virgin deciduous forests of a temperate region. The inference is drawn that the density of shade in the deciduous forest in the temperate region is by no means so great as is that of the dipterocarp forest; hence the more rapid growth of the yellow poplar. The influence of absence of light on the suppression of growth is shown to be even more pronounced in more dense forests. Thus measurements made on dipterocarps in another more dense forest than that in which the above measurements were made shows that the average dipterocarp is 116 years old when 2 inches in diameter!

Measurements made on Parashorea grown in the open show entirely different results. Before discussing the results of these measurements, attention should be called to the fact that in another connection the authors present evidence to show that dipterocarps suppressed in youth are entirely destroyed by insolation when the forest canopy is entirely removed, and that a light shelter is needed to save the crop after the forest is cut. Also it is impossible to start dipterocarps from seed without such shelter. The measurements referred to above were taken in a natural pole stand that had such a shelter in early youth and this shelter has since disappeared, so that the forest is now entirely without shelter. These measurements show that a tree of Parashorea grown in the open attains a diameter of 8 inches in 23 years, and the same tree grown in the dense forest attains this diameter in 106 years. Assuming that the trees grown in the open have the same rate of growth as those grown in the forest after they pass the 8-inch-diameter class, it is computed that it takes a tree twice as long to attain a diameter of 26 inches in the dense forest as it does when grown in the open.

Measurements of seasonal diameter growth were taken by the authors. Their results show that while growth in diameter takes place throughout the year, that there are two periods of rapid and two of slow growth. The first period of slower growth is most apparent at the height of the dry season in April. After this the rate of growth increases until June and July, just after the beginning of the rainy season. From the end of July to the first of October there is a decided minimum, and following this, from October to December, there is another maximum. The changes in growth coincide with climatic changes and are probably dependent upon them. The first period of slow growth is during the dry season. This is attributed to the fact that there is a high rate of evaporation. The second period of slow growth is during the height of the wet season.

This is attributed to the fact that during a large portion of the time the sky is overcast and light conditions are much less. At the beginning and close of the wet seasons the most rapid growth takes place. It is pointed out that then the light conditions are more favorable than during the wet season, and that the available moisture is sufficient in the soil to offset the increased evaporation.

Measurements of the environmental factors of temperature, rainfall, soil moisture, and evaporation were made and interesting comparisons are made. Thus the temperature in the undergrowth of a forest for a year shows an average of 26° centigrade for the maxima and an average of 21° for the minima, while during the same period the maxima in the top of a dominant tree showed an average of 32° for the maxima and 20° for the minima. The evaporation in the top of a dominant tree shows a rate of more than six times that on the ground in the shade of the forest.

The authors discuss the effect of cutting in the dipterocarp forest. Their conclusions are that the use of the selection system, operated by means of a diameter limit, the method in use in the Philippines, is not at all successful in perpetuating the forest. The diameter limit in use is 20 inches. This for a temperate region would be considered high. But in the overmature forests at Negros, under consideration, there are a number of factors that operate against its successful use. The dipterocarp forest of Negros, in the first place, does not meet the necessary condition for such a system, for nearly all the dipterocarps are above that diameter, so that the operation of the selective system really results in a clear-cutting one. The few trees that are left after such operations, due to the sudden exposure of insolation, are killed in a short period of time. The great majority of the seedlings are killed for the same reason. The same result obtains in the forest of Bataan described above. In northern Laguna, however, the forest and the methods of logging are well suited to the diameter-limit selective system. The success here is due in part to the better distribution of age classes and in part due to the fact that the logging has not been intensive. It should be pointed out in this connection that in Negros and Bataan modern machinery is used in logging, while in northern Laguna the logs are extracted by water buffaloes.

The authors advise the use of the shelter-wood system in the place of the diameter-limit regulation.

Experiments in planting dipterocarps so far have not been successful. If planting operations prove advisable, the authors recommend the use of trees that are known to be more easily handled than dipterocarps.

The reviewer considers this article the most valuable analysis of the nature of dipterocarp forests that has been published. While some of the conclusions are based on meager data, yet a good start has been made in

solving the problems connected with their management. If the dipterocarp forests of the Philippines are to be brought under rational management and saved from total destruction, it is very clear that a radical change will have to be made in the present system of handling them.

H. N. WHITFORD.

YALE FOREST SCHOOL.

LIFE HISTORY OF SHORTLEAF PINE [1]

This paper gives a very satisfactory and comprehensive account of the life history of shortleaf pine under the following heads: Name and identification, range, character of stands, size, age, and habit, demands upon soil and climate, light requirements, reproduction, growth, causes of injury, yield. The written matter is well supported by numerous photographs, diagrams, curves, and tables. The results of the studies conducted throughout the range of this species—New Jersey, North Carolina, and Arkansas—upon which the publication is based are of much practical value in the management of shortleaf-pine stands. Some of the findings are of especial interest, which are best quoted:

"In well-stocked stands of shortleaf pine a very close relationship has been found to exist between the diameter of the tree at breast height and the diameter of the crown. This relationship is striking in its constancy and, so far as is known, has never before [January, 1913] been found to exist in any North American tree species."

As the author states, this law can be nicely used in determining diameter class and the total number of trees that can most profitably be grown per acre in a well-stocked stand. Density on the ground at any age can likewise be ascertained.

The thrift and hardiness of the species is emphasized in various parts of the paper. As to light requirements under similar conditions, it is more tolerant for development throughout life than longleaf,

"but does not in early life tolerate shade so well as loblolly, but retains longer the power of growth under limited light supply, showing this retention of power by a relatively later and slower decrease in tree density."

Shortleaf stands among the foremost of valuable pines in the United States as a vigorous seed producer, and the seed has some advantages over other species in its "marked ability to germinate successfully in grass and leaf litter" (W. W. Ashe, Proceedings Society of American Foresters, Vol. V, No. 1, Loblolly and Shortleaf Pines).

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[1] Wilbur R. Mattoon. Bulletin 244. U. S. Department of Agriculture, Washington, D. C. Professional paper contributed by the Forest Service.

"This is in line with the inherent capacity of the species to thrive on the lighter upland soils deficient in soil moisture."

The small seed and large wing cause it to be borne two to five times the height of the tree and one-eighth to one-fourth of a mile in strong winds.

The species sprouts vigorously when young, and of the important commercial pines in the United States is the only one capable of complete reproduction in this way, although *P. rigida, P. serotina,* and *P. chihuahuana* have this ability more or less.

"Few seedlings reach ages of three to six years without being burned back, and most forest stands have passed through this experience on repeated occasions."

Since surface fires are a great menace throughout the range of the species,

"this feature highly recommends it for profitable management throughout its range."

The largest yield the paper records is 55,750 feet b. m. per acre, Scribner rule, 70 years of age, based on 38 fully stocked sample plots of 5.8 acres, in which all trees 6 inches and over d. b. h. were scaled to a top diameter of 5.5 inches and 1 foot stump height.

"In good situations in Arkansas well-stocked 160-year-old stands have average yields of about 45,000 board feet, or approximately the same as 58-year-old stands on similar situations. The highest average annual production of natural unthinned stands is probably between 90 and 100 years in Arkansas and some 10 years earlier in the central Piedmont region."

In mixed stands large areas in central and western Arkansas and adjacent portions of Oklahoma and Louisiana will cut an average of 5,000 feet, although the mountain sections of the Arkansas and Ozark National Forests and northern Georgia more commonly average 1,500 to 2,000 feet per acre.

FRANCIS KIEFER.

FOREST SERVICE,
WASHINGTON, D. C.

SHORTLEAF PINE: ITS ECONOMIC IMPORTANCE AND FOREST MANAGEMENT [1]

The title is a comprehensive announcement of the contents, and the introductory sentences forecast the substance of the publication.

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[1] Professional paper, United States Department of Agriculture, Bulletin No. 308. Contribution from the Forest Service, by Wilbur R. Mattoon.

"In a considerable portion of these regions shortleaf pine excels all other coniferous species in value and profitableness as a timber crop. It is one of the more important commercial pines and, because of the following qualities, promises to supply much of the future timber crop: (1) Quick and persistent growth; (2) rigor of reproduction and high-sprouting capacity during youth, when most susceptible to serious injury; (3) quick response to increase of light secured by thinning; (4) characteristically tall, straight, and clean trunk; (5) intermediate quality of wood, which fits it for a wide range of uses, and (6) the gregarious habit of the species in pure stands, resulting in large yields of high-grade timber per acre."

A conservative estimate of the shortleaf-pine supply is given as 80 billion board feet. The annual cut of yellow pine in 1913 is said to be 14,839,363,000, which equals nearly as much as the combined output of Douglas fir, oak, white pine, hemlock, western pine, and cypress. An approximate estimate of the present total annual cut is 3,500,000,000 board feet. The continually increased contribution to the annual cut from second growth in old-field stands is a conspicuous statement.

As to utilization in the woods, an incongruous condition is reported wherein stumps were cut in one operation near ready market (March, 1913) to a height varying from 20 to 34 inches; at the same time all other material up to 2 inches in diameter was shipped by rail for fuel wood. In less accessible regions woods utilization does not extend beyond 8, 10, and 12 inches in the top. In level, low-cost logging regions small diameters are removed frequently for the reason that fire consumes the remaining stand; but this is refuted by the statement of one operator that his actual count reveals fire to destroy only 5 to 15 per cent of the trees above 3 inches in diameter.

The extended use of short and odd lengths, with more careful grading combined with chemical uses (all of which are constantly developing), are suggested as (direct) agencies leading to more thorough mill utilization. To this may be added the influence of more favorable prices, marketing, and demands of the consumer.

The wood is described as straight-fibered, uneven-textured with alternate hard and soft concentric rings, resinous and moderately heavy, hard and rapid growing and easily worked, receptive of good finish and favorable to paint and wood preservatives. It is only moderately durable in contact with the soil. Because of its strength and stiffness, it is a valuable structural timber. Although longleaf is the structural favorite among southern pines, shortleaf has in many instances given equal service. The similarity of the wood to longleaf, in addition to its variety of constructional uses, suggests its adaptability to the sulphate and soda-pulp processes.

Logging, milling, cost, waste, grades, market, lumber prices, and stumpage value are also ably treated. It is interesting to note the increase in stumpage values from 41 cents in 1896 to $3.35 in 1912 per M feet b. m. This much of the bulletin occupies 24 pages.

Thirty-one pages are then devoted to an able treatment of management under the following heads: Protection, fire, insects, fungi, yield, rotation, thinnings, relation between tree density and yield, trees to be removed, returns from thinned stands, cutting and reproduction, pure stands, mixed stands, cutting on the National Forests of Arkansas, regeneration by sowing and planting, methods, form of plantation, protection, and cost.

The discussion of fire protection states that

"Fire lines . . . are proving effective in the yellow pine on the National Forests of Florida and Arkansas. A double furrow stops slowly burning surface fires. . . ."

The reader assumes that plowed fire lines are employed on the Arkansas National Forest with equal frequence as in Florida, while in reality cleared strips in the form of roads and trails are the practiced form of fire lines in the two Arkansas forests because of the rocky soil which precludes plowing, as the author doubtless intends.

The serious depredations of the southern-pine beetle (*Dendroctonus frontalis*) is emphasized by the estimate that the loss by this cause during the preceding 20 years is estimated between 10 and 20 million dollars. Methods of control discussed in reference to Farmers' Bulletin 476 offer the practical suggestion of

"Converting the trunk of the infested trees into cordwood and using the wood for fuel before the beetles leave the bark, or converting the infested trees into lumber or other products and burning the slabs or bark."

An appendix of volume tables and form tables is attached. The publication is a noteworthy and valuable contribution, generously supplied with diagrams, tables, and photographs.

FRANCIS KIEFER.

FOREST SERVICE,
WASHINGTON, D. C.

SOCIETY AFFAIRS

DISCUSSION

of the Proposed Changes in Membership

The members have now before them the ballot sheets for voting on the proposed changes in membership. The ballot should be filed with the Secretary of the Society by December 1, 1916. It has been suggested, however, that the ballot be not made out or mailed until after November 1. This has been provided in the interests of full discussion and consideration of the important changes proposed. To initiate such discussion, brief statements regarding the constitutional provisions dealing with membership from Dr. Fernow and Mr. Clapp have accompanied the ballot. A further discussion of the amendments suggested is included in this issue of the Proceedings.

The Executive Committee

The views of the Executive Committee regarding the amendments are as follows:

Membership

During the past two years there has been a general demand throughout the Society for broadening and classifying its membership. Under the provisions of the Constitution, active membership is limited to "professional foresters of achievement," which excludes a large number of men who are identified with forestry by their work and interests and who would contribute to the strength and effectiveness of the Society could they be made a part of it. The forest schools are turning out each year a large number of trained foresters who become identified with some branch of forestry and are interested in its development in America, both scientifically and professionally. It has been felt by many members of the Society that these men should have a place in our ranks, both for the value of their numbers, enthusiasm and interest in the work of the Society, and for the aid which the Society in turn can be to them. The same thing has been recognized by the American Society of Civil Engineers and other scientific organizations, which have provided a class of membership which admits men of professional training at or before the completion of college work. Another large group of men have had no

technical training, or but limited technical training, but through their work have acquired a practical knowledge of forestry and a valuable place in the profession, broadly viewed.

In applying the requirement of "achievement," the Committee on Admissions has necessarily had to make many close decisions and to decline to elect a number of men whose qualifications as professional foresters were well recognized, but who could not in fairness to the standards maintained by the Society be made Active members. In many of these instances it has appeared unfortunate that no opportunity existed to enroll such men in the Society in a grade of membership adapted to their qualifications.

The suggestions received by the Executive Committee reflect two quite divergent views of the basis of broadening and classifying membership which should be adopted. These different conceptions cannot be satisfactorily harmonized, and each appears to have many advocates. It has seemed desirable to the committee, therefore, to embody each in a consistent set of amendments and include both on the ballot.

The first plan provides for the grades (1) of Member with simple qualifications and (2) of Senior Member, which continues the present requirement as to achievement. The second plan provides a more elaborate classification, with the aim, however, of making its application largely mechanical and eliminating considerations of achievement except to a degree in the highest grade. This plan affords separate grades for (1) forest students, (2) practicing foresters without technical training, (3) practicing foresters of experience, limited largely to technically trained men, and (4) men of recognized maturity and high professional standing, who will be those of technical training exclusively. Each plan continues the present grades of associate and honorary members, with little change.

An important feature of each proposal is its restriction of governing functions. Each limits elected officers to the highest grade. The first, whose highest grade will embrace a much larger number of men (the entire present active membership), restricts the lower grade to voting power in the election of officers only. The second gives the next lower grade—probably the largest numerically—the ballot in all Society matters.

In connection with the second plan, it may be of interest to note that the rolls of the Society now contain 136 men of technical training who would meet the qualification of Fellow as to 10 years of professional work, aside from 18 men of similar length of service, but without technical training. A check upon about half of these men indicates that practically all of them would meet the age qualification.

A second important feature is the adjustment of dues. Each plan recognizes the principle that members of the highest grade, carrying the largest privileges and responsibilities, should pay more toward the support of the Society than those in any other. The dues throughout are based upon the assumption that $3 yearly will just cover the cost of the enlarged Society Journal. Under the second plan, it has been felt equitable to assess the two lowest grades of members only the cost of the Journal. The third grade is asked to contribute $2 more, to defray the cost of general Society work; and the fourth grade, or Fellows, twice that amount, or $7, all told. Under the first plan, it is felt reasonable to ask the lower grade of members, in consideration of the voting power for officers, to pay $1 annually for general Society work, aside from the cost of the publication; and the higher grade to pay $2 annually for general expenses, or $5, all told.

The experience of the Society has shown that, to obtain the type of men whom we desire as associate members, they should be charged no dues, but left to subscribe to the magazine independently if they desire.

In accordance with the action taken at the last executive meeting of the Society, the Executive Committee has included a new section, which makes membership available to women on the same terms as in the case of men, and a few slight changes requested by the Committee on Admissions as a means of expediting its work. The most important of these is a reduction in the time elapsing between the submission of the names of candidates to the members and final action thereon from two months to one month. Experience has indicated that one month is ample for this purpose, and that the two-month requirement simply imposes an extra element of delay.

Increase in Dues

The amendments proposed provide for restoring the dues for the majority of the members to $5 per year. The Executive Committee again urgently recommends the approval of this change. On its present resources the Society is able to conduct its work only by very close economy and by curtailing a number of desirable activities. The Treasurer's report for 1915, published in Volume XI, No. 1, of the Proceedings, shows a balance of $368.24, after deducting from the assets the reserve supply of Volume X, the cash returns from which are problematical. This balance has steadily decreased from year to year, due to enlargement of the Society's work in the size of its publication, in such activities as the work of the Committee on Terminology, in the cost of occasional meetings of special importance like the meeting held last year at San Francisco, and

the like. The Executive Committee is now confronted with the problem of publishing an extremely valuable report on forest terminology, including a glossary of over 1,200 terms in lumbering, representing exactly the sort of thing which the Society should be able to do. The last executive meeting indorsed the plan of holding each year a public meeting in connection with the American Association for the Advancement of Science, with which the Society is affiliated. Such meetings would do much toward making the Society a greater factor in the scientific life of the country.

All of these developments will be seriously handicapped if the financial resources of the Society are restricted to their present amount. Out of the $3 paid annually by each Active member, $2 is required to carry the Proceedings, leaving $1 for the general work of the Society. This is inadequate, unless the Society is to stand still in its growth and influence.

The question of dues is also important in connection with the proposed amalgamation of the two publications. As indicated in the report of the Executive Committee for 1915, the cost of the combined publication is estimated at from $2,700 to $2,967.60 annually. Broadly speaking, the execution of this plan will require a levy of $3 per member of the Society. This will consume practically the entire present income from dues and, without an increase in them, would leave a serious problem to be solved in providing for the general work of the Society.

The proposed increase in dues to $5 would provide $3 for the support of the magazine and $2 for general Society work. Members who now pay $3 to the Society and $2 as a subscription to the Forestry Quarterly would stand just as at present; but the Society would be able to develop its technical work in many desirable directions that would otherwise be impossible. The Executive Committee, therefore, very urgently recommends to the members of the Society that the amendments providing for increase in dues receive their favorable vote.

The Executive Council

The present executive organization of the Society is weak because uncorrelated. Aside from the appointment of standing committees, the President has no organic connection with the executive work of the Society, which is lodged largely with the Executive Committee. This committee, on the other hand, is at a disadvantage because of its lack of organic connection with such important activities as the Society's publications and the committee in charge of meetings. It controls the funds of both, but has no voice whatever in policies or methods. It would seem, furthermore, that the very important duty of electing members to

the Society should be discharged by men chosen by ballot rather than by an appointed committee.

Considering all of these points, it is felt that the direction of the Society's affairs would be greatly strengthened by adopting an executive organization based upon the English Cabinet system. The executive body should include all elected officers, and only elected officers, with the exception of the Editor-in-Chief of the publication. This position, with its peculiar technical requirements, can, it is believed, be best filled by the Executive Council itself. By having the heads of all permanent lines of Society work together in one governing body, with the President as its chairman, all activities will be tied together in a well-correlated organization. It is necessary, however, to keep the Executive Council as small as possible. For this reason, it is proposed to delegate the election of new members to it rather than to a separate, elected Committee on Admissions.

It is also desirable to define the authority of this Executive Council more explicitly than is done by the present Constitution in the case of the Executive Committee. This has been done (1) by authorizing it to draft by-laws and (2) by delegating to it all executive duties not otherwise provided for in the Constitution. The former is of special importance because of the need from time to time for formalized rules of procedure in connection with the development of local sections and other growing phases of Society work, which cannot be fully anticipated.

The Executive Committee earnestly recommends the adoption of the Executive Council as authorized in the proposed amendments.

Change in the Name of the Society's Organ

Regardless of the amalgamation of the Proceedings with the Forestry Quarterly, it seems desirable to the Committee to change the name of the "Proceedings." This has long been a misnomer, since but a small part of the publication deals with the actual doings or transactions of the Society, the major portion consisting of technical articles submitted to it for publication which have never been presented to the Society. In keeping with this character of the publication, it is believed by your committee that the "Journal of Forestry" will be a more suitable title.

It is felt to be advisable, however, to leave the name of the Society's organ open to action by the Society from time to time rather than fix it in the Constitution. This will be accomplished by the amendments proposed to Section 4 of Article VII and Section 5 of Article VIII. A separate ballot on the proposed change in name has been provided.

Organization of Sections

Provision is made in the proposed amendments for reducing the number of members necessary to the establishment of a local Section from 10 to 5, and for authorizing each Section to fix in its by-laws the qualifications for associate members in that Section and to elect its own associate members in accordance with such qualifications. Such election will not, of course, carry with it associate membership in the main Society.

It is the object of these amendments to provide greater latitude in the establishment and personnel of local Sections, and to give each Section greater freedom in the conduct of its own affairs and extending its local influence.

In revising the Constitution the Executive Committee has included one or two changes designed to carry out more fully the purpose of the Society to embrace Canadian forest interests as well as those in the United States. This was one of its original objects, as embodied in its constitutional provisions covering membership. The amendments proposed simply carry out this original purpose somewhat more clearly.

Respectfully submitted for the Executive Committee.

W. B. Greeley,
Chairman.

Dr. Fernow:

My Dear Mr. Greeley:

I have your painstaking and excellent elaboration of the three propositions in parallel columns for the revision of the Constitution, and thank you for the opportunity of expressing my opinion. I am an unconditional advocate of the third proposition, which embodies most if not all the propositions that I had submitted in May, the two essential ones being the complete classification of membership and the reorganization of the executive work of the Society through a Council.

I also favor the proposed wording of Article II, which accentuates the professional character of the Society. Indeed, I would suggest that the reading stop at the word Canada, leaving out a statement of the means of attaining the Society's aims as unnecessary.*

I believe that the organization of an Executive Council as proposed and the transfer of all business functions to it, and especially the function of electing members to be handled by an elective rather than appointed body, will recommend itself to the membership without much argument.

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* The wording of the object of the Society has been materially changed since Dr. Fernow's letter was written.—Greeley.

The greatest divergence of opinion, I expect, will be as to the classification of membership, and I may be permitted to explain that the proposed classification, largely based on the precedent of other successful engineering societies, is a compromise between the views of the conservative and the radical elements in our membership. It is democratic, inasmuch as it makes room for almost anybody who has a professional interest in our aims. It is aristocratic, inasmuch as it reserves the management of affairs to a select body of the membership—the older men. The division into classes takes place almost automatically and relies as little as possible on judgment, which in the hitherto required "achievement" clause appears to have been a bad stumbling block, and has given rise to frequent dissatisfaction by keeping out worthy followers of our profession, by no means "fostering a spirit of comradeship among foresters."

The only objections I have so far heard to this classification is that it is complicated and that it is not necessary.

The careful reader will not find it complicated, but natural, practical, and complete, giving opportunity to every forester to benefit from the association.

It is not necessary, but it is desirable to have a working plan which does not need to be changed or interfered with in general principles. While we are revising we might as well do a thorough job instead of being called upon to tinker again and again. The objection that at present the class of Fellows will be quite limited will correct itself every year more and more. Other classes of membership will double their number in a short time.

The dues have been kept within a reasonable limit for effective work. Eventually they may be raised to the figures I submitted, when a paid secretary may be employed.

I am in entire accord with the arrangements regarding sections and affiliated societies as proposed in the third proposition.

Sincerely yours,

B. E. Fernow.

The following excerpt is taken from Dr. Fernow's letter to the Executive Committee of June 12, 1916:

"The most important proposition is, of course, that of a classified membership, and on this proposition I would like to renew the arguments which I brought before you verbally at our meeting in May for a still broader classification and for a method of applying the same. These I bring after a very careful examination of the various classifications of eight other engineering societies.

"We should realize, first of all, that our Society distinguishes itself from all other engineering societies by the fact that the majority of members will always be in government employ, national or State; therefore, the commercial incentive to become a member, which exists in other societies, is largely lacking; from a business point of view, the advantage of membership is small, and we must make the most of the professional advantage.

"This has an influence, particularly on the dues, which can justly be considered fair, and for which adequate returns can be expected.

"Another difference is the scattered distribution of the members of our profession, which with the still small number makes largely attended Society meetings impracticable. This suggests that the organization of sections should be an essential organic feature of the Society.

"A third difference is that we are still in a stage where it is needful to make propaganda for the public recognition of our profession. This makes it desirable to offer inducements for the joining of non-professional men who can benefit our profession, even if they become only members of a section, not of the Society itself.

"In the societies examined, which have memberships ranging from 1,000 to 8,000, besides Life and Honorary members, eight classes of membership, from two in the simplest (architects) to six in the most elaborate (Canadian Institute of Mining Engineers), are recognized. The fact that to secure membership in the Architects Institute requires an entrance fee of $30, besides an annual due of $20 and $25, prevents indiscriminate admission, and none but the one class of practicing architects manages affairs. Altogether, the dues in these societies are in none below $10, with entrance fees from $10 to $30. The classification is mostly based on age, length of practice, and length of holding responsible or directive positions. These time limits overcome mechanically the achievement clause, which, in our Constitution, has been the most difficult to construe without invidious distinction.

"If it is desirable, as I for one believe, for our Society to have an all-comprising, large membership and yet keep a high professional standard, these two objects can be best accomplished by a classification into five classes (besides Life and Honorary), at the same time leaving the management of affairs to the two professional classes.

"Such classifications as these would admit everybody who has a real interest in the profession and feels that he would be benefited by membership, while the affairs of the Society would be managed by the professional men and mainly by the older settled group—those who have given evidence of their persistency and fitness in the ranks."

Dr. Fernow:

Although I have already twice been heard on the proposed changes in the Constitution, the Editor desires me to appear once more in the space allotted to the discussion of this matter in the Proceedings.

All I can add to the arguments is to accentuate the fact that both the new classifications are bound to change the character of the Society from a collection of the "elect" to a gathering of all the bona fide foresters of standing. The only objections to the simpler classification that I can advance are:

1. That it is not as all-comprehensive as the wider classification, and that eventually we will be called upon again to reclassify, which is always a wrench.

2. That as basis of classification, it still adheres to the doubtful concepts of "creditable" and "achievement" without defining at least in general terms what may be considered as elements of such characteristics, leaving it entirely to the judgment of the electing committee—sure to lead to the same trouble which we have experienced.

This trouble the wider classification avoids by substituting at least in part a mechanical standard of measurement as an expression of creditable work and achievement, reducing judgment to a minimum.

We have to realize that "achievement" means something different at different periods of development. What was properly considered achievement in the early stages of the professional development will appear commonplace routine work in later days.

I am for the more comprehensive and more democratic classification, which makes room for practically every practicing forester, and which is based upon the experiences of older successful societies of similar character.

Earle H. Clapp:

To the Executive Committee:

In accordance with the request of your Chairman, I am glad to submit the following statement on the membership question now under consideration by the Society:

Present membership classes of the Society include:

1. Active members. The governing body of the Society and by far the largest membership class, elected from professional foresters primarily on the basis of achievement in the active practice of the profession.

2. Associate members. Persons of achievement in lines of work closely relating to forestry who have shown substantial interest in American forestry.

3. Honorary members. Chiefly from those who have rendered distinguished service to forestry in America or elsewhere, and from professional foresters of achievement whose field of work is outside of that specified for Active members.

I indorse the more simple of the proposed modifications of the Constitution, which adds two new classes of members:

1. Members, to provide for the admission of a class of men who have adopted forestry as a profession, who desire membership and have not yet had the opportunity for achievement warranting election to the present Active (proposed Senior) membership class. Qualifications for election to this new class are, therefore, professional training plus an additional year of work as an assurance that the candidate is permanently in forestry work, or, as an alternative, at least four years of creditable work in some branch of forestry.

2. Associate members of sections, to provide for the admission of members to sections in accordance with the by-laws any section may adopt to fit its local needs, subject to the approval of the Executive Committee (or Council).

I favor this plan because:

1. It fully meets the requirements of the Society in its present stage of development.

2. The Society is still too young; there is still too little difference in age and achievement among the men in the American profession to establish a Fellows class which may become more suitable in the future when a much larger percentage of the profession has reached advanced years, with records of distinguished service.

3. The Society should not repudiate its past elections on the basis of achievement to the Active membership class—the largest by far and the governing class of the Society—by materially reducing the qualifications for the election to this class and depriving its membership of the privileges of office-holding and activity in the Society which they have always held.

3. The democratic principles of the original organization of the Society should be maintained, and the bulk of its membership should share equally and fully in its membership privileges. Full active participation in the government of the Society should not be delegated to an oligarchy for election to which more emphasis will be placed on academic training than for election to the present Active membership, and the principal other qualifications will be age and period of service.

COMMENTS

H. F. Weiss:

I favor the plan of Junior, Associate, Member, and Fellow grades, because this plan accomplishes all that the other plan proposes and goes further in that it sharply recognizes professional accomplishment. I

believe that recognition of this kind is as desirable in forestry as it has proven to be in chemistry, engineering, and other sciences. In fact, I believe the grade of "Fellow" should be more stringent than proposed. It should be looked upon by foresters as a distinct honor to be chosen a "Fellow"; but no Fellow should be chosen unless he is a technically trained forester. This and the fact that a Fellow should vote and hold office distinguishes a "Fellow" from an "Honorary" Member.

In my opinion, however, there is a serious objection to limiting, in a society as young and as diversified as ours, the holding of office by "Fellows" only. I am opposed to this. I believe the right to hold office should be extended to the "Member" grade as well.

In brief, my views crystallize to this: Stiffen the requirements for the Fellow grade—and liberalize the right to hold office. I believe this modification of the plan proposed recognizes professional accomplishment without destroying that democracy of control which typifies our American institutions.

E. A. Sterling:

The creation of a grade of Junior membership is advisable from every standpoint. It affiliates the students or recent graduates of forest schools with the older men in the profession, and inspires them to seek for the higher membership grade. It might be questioned whether Juniors should be confined entirely to "students or graduates of forest schools." Might there not be men in subordinate capacities who have not had forest-school training, and yet might be entitled to affiliation in a low grade of membership without hope or promise of ever getting any farther? Although men of this kind will be taken care of as Associate members, is the distinction between these two grades clear enough?

Provision A, under Section 3, tends to run technically trained men through a mill. The requirement of technical forest-school training, followed by three years' work of "a creditable character," constitutes the measure of qualification. Is this a more definite qualification than the old clause regarding achievement? Except in case of men who are total failures, they will be automatically qualified for membership three years after they leave the forest school.

Provision B inspires no comment, except that it offers a route to Active membership through two years' affiliation as Associate member. This opens a way for men without any technical training to achieve Active membership, and perhaps in certain circumstances is all right, but should be very closely guarded.

Provision 4, regarding "Fellows," seems to me premature. The honor of being classified under this heading is questionable when comparison is made with the status of fellows in similar professional organizations. Not only the Society of American Foresters, but the whole profession is so young that the transfer of the older Active members to a Fellowship list seems unnecessary and in no way helpful. The exercise of a strict consideration of distinctive requirements would probably not be closely followed. If it is, feeling will be aroused; if not, the honor is certainly an empty one. It is my personal feeling that greater consideration should be given as to what ends, if any, are to be attained by creating this Senior class of membership.

Sydney L. Moore:

Regarding the constitutional amendments proposed by the Executive Committee to be voted on December 1 next, I wish to heartily indorse the views of Dr. Fernow, given in his statement sent out with the ballots.

As to the arguments advanced by Mr. Clapp in advocacy of the plan he favors, and thus necessarily against the other plan, it seems to me that the answers to his conclusions, taking them in order, are as follows:

1. His plan may fully meet the present requirements of the Society, but this does not preclude the other plan from meeting them in fuller degree.

2. I think the Society is old enough, so that there are marked differences in age and achievements among the present members (there are 154 men of over 10 years' professional work), and I believe the newest members of the profession and Society willingly and generously admit such differences.

3. Clapp speaks of "repudiation." If the third-column plan is approved, it will be so only by a majority of our members. We are all accustomed to accept majority rule. Should the third-column plan be carried, I do not think that the minority against it would feel that they had been repudiated, but would cheerfully accept the majority decision as of course.

4. I think Clapp's citation of "democratic principles" is a specious argument. We all believe thoroughly in political, social, and industrial democracy; but what scientific or professional man does not willingly recognize an aristocracy (if such it should be termed) of scientific and literary achievement?

As to the third-column financial plan, I feel that we all ought to pay larger dues for the benefits of the Society—at least $5 per annum. The

larger dues ($7 per annum) would, I believe, be paid willingly by all who might enjoy the larger privileges of membership.

As regards making women eligible for membership, I favor the modern Feminist movement in its broadest aspects (including Woman Suffrage); but I believe that certain lines of endeavor will always be restricted practically to men, just as some other lines will be more efficiently handled by women. I realize that in some special lines of forestry women have already accomplished notable results. But I feel that in its broadest fields the profession of forestry is of necessity, or most suitably and logically, a man's profession. I would favor a plan to open Associate or Honorary membership to women, but am opposed to opening all memberships to them.

Allen S. Peck:

I want to take advantage of the opportunity offered for discussion of the proposed amendments to put in a word for the simpler of the two forms of classification of membership proposed. I really can add no arguments to those set forth in Mr. Clapp's statement; but I want to urge that every member of the Society consider that statement with care before voting. I think most of us have been convinced that the Society needs a larger field of usefulness, and that this can best be brought about by making possible the affiliation with the Society of a considerable number of men who are not now eligible for membership.

One objection to classifying members into various grades has been the government by oligarchy that would result. I am convinced that this departure from the democratic form of government will be less pronounced under the plan of Members and Senior Members than it would be under the more intensive form of classification. The question as to "Fellows," it seems to me, is entirely unrelated to the pressing problem of enlarging the sphere of activity through increasing membership which the Society is now trying to solve. Whether or not we are to have "Fellows" can well go over until a later time, it seems to me, when the need for such an honorary distinction may be more keenly felt.

Thornton T. Munger:

I am glad to have an opportunity to express my opinion upon the proposed membership requirements of the Society; but Dr. Fernow's and Mr. Clapp's statements in the recent circular of the Executive Committee leave little to add to the pros and cons of the two schemes. Dr. Fernow points out, in a way that is hard to disagree with, the need for a thorough

and complete classification of membership, yet I personally favor the simpler scheme which provides for but two classes of members (aside from Associate and Honorary membership).

It is not likely that the Society of American Foresters will ever become so large as such an organization as the American Society of Civil Engineers, in which several classes of active members are no doubt practicable and desirable. Two classes of membership should meet every present and probable prospective need of the Society; to attempt further classification would dismember the organization as a unit, especially in the Sections. Besides being unnecessary, a highly refined classification of membership would seem to be difficult of application, partly because the personnel of the Society is all so young, and partly because so large a proportion of it is in the employ of a single organization. The Forest Service and the profession in general have always been so democratic that I question whether it would be well for either the Society or the Service to attempt to draw lines on the basis of various degrees of achievement. The openness of the Society's meetings and its democratic spirit partly accounts for the fact that membership itself has been held so unimportant in the past.

Difficulties might be encountered in putting into effect a plan that involved several classes of members. There will be frequent transfers from one grade to the next, and since the membership is so widely distributed geographically and never is largely represented at any meeting, a great deal of business must be done by correspondence. The real work of the Society from now on is to be done in the Sections. Each of them is small; its meetings are of the most informal and democratic nature, and it should not be embarrassed by an oligarchic classification on paper of its few participants.

Does not the simpler scheme as proposed fit the needs of the Society for as many years ahead as we can see? It accomplishes the purpose of increasing the membership by opening the Society to the younger men, and this is *the* important, if not the only, need for a classification of the membership at this time.

Ralph S. Hosmer, Samuel N. Spring, A. B. Recknagel:

We favor the plan as given in the third column of the ballot, even though it is more complex than that given in the second column. The proposed changes in the second column, after all, differ but little from the present wording; the provisions for membership are still restrictive. The crux of the question is, Shall we increase our membership? It seems

to us that the opening of the Society to Junior members is a vital point which we strongly favor.

There is no provision in the proposed constitution as to *who* may wear the insignia of the Society. This should be settled by the Executive Committee.

The American Society of Civil Engineers in its constitution (February, 1915) provides that badges are not issued to Juniors.

We believe that the present green badges should be restricted to Members and Fellows, and that a badge of a different color should be given the Associates and Associate Members. Juniors not to have any badges and Honorary Members not to have any badges.

There is apt to be a confusion in the names "Associates" and "Associate Members." Some other term for one or the other should be found. It is up to the Executive Committee to do this.

The 136 members now eligible for Fellowship, provided they meet the age requirement, should become Fellows immediately; *their* election should not depend on the Executive Council, though this body should elect Fellows in the future. If this is not done, no provision is made for an adequate body from which to choose officers of the Society.

While personally we should be willing to pay $7 as Fellows, it seems doubtful whether it is expedient to fix the dues for Fellows at so large a sum, in view of the fact that in the past even $5 dues were considered onerous. Furthermore, should it not be taken into account that the men who serve as officers give their time gratuitously? Would it not be possible to raise the necessary extra moneys for current expenses of the Society through voluntary contributions?

We believe that a considerable number of men would respond to such an appeal who would not favor dues of $7 for Fellows. We believe that the Associate Members should continue to pay dues as at present ($2); if they wish to receive the publication of the Society they should pay $3 extra.

Donald Bruce:

The most vital and perplexing issue now before the Society for decision is undoubtedly that of membership standards and classification. Opportunity is afforded to vote for one of three concrete plans. I find myself in the embarrassing position of not being able to whole-heartedly support either.

The lower limit of membership stated in the second proposition is, I think, the best. We need the increased strength resulting from a larger enrollment, and a wider dissemination of the benefits of the Society is

desirable; but to go so far as to include forest-school students, many of whom will never become foresters at all, is to me too extreme a measure.

To draw a line between members elected in accordance with the existing standards and those to be elected under the revised lower standards does not appear to me particularly essential, and in this I prefer the third plan. The interpretation of these standards in the past has been very far from uniform, in spite of the earnest efforts to the contrary of later years. Even the supporters of proposition number 2 urge in its favor that the qualifications for the proposed "Senior Membership," though almost identical with those for "Membership," as now defined, will be more strictly interpreted on account of the existence of a lower grade.

While the distinction thus hardly will accomplish what is intended, I see, however, no particular harm in it.

The creation of a grade of Membership of decidedly higher classifications than the present, as proposed in proposition number 3, appeals to me as particularly desirable. "Encouraging achievement" is a proper aim of the Society and one of too much importance to have the highest award conferred upon men but 4 or 5 years out of college. The classifications for "Fellow," as stated in proposition number 3, do not, however, appeal to me. They should, I think, be more strictly defined and lay more emphasis on exceptional accomplishment so as to make election a very signal honor and not the result of meritorious seniority alone. Under these conditions the number of "Fellows" would be less and their influence inevitably very great. Legislative concentration of too much authority in their hands might well prove embarrassing. Certain honorary offices should be filled from this class; but other offices might well be open to the next lower degree of membership, and the voting power should rest with the Society at large. It would be more democratic to leave elections to this grade in the hands of the Society at large, which would be competent to redeem this responsibility, because only men of national reputation, whose work is well known to practically every Society member, could hope to receive this honor. The restriction of this grade to graduates of technical schools seems unwarranted. A man achieving very high distinction in forestry on the basis of a self-taught technical training is by so much the more deserving of recognition.

Proposition number 2 appeals to me as better in the matter of Associate membership and for much the same reason. Whatever Junior grade may be established should be open to all men of technical training, whether this training is obtained in school or out. It seems also well worth while to keep a place for workers in allied fields who are not eligi-

ble to Honorary membership, and this proposition 3 does not appear to do.

My personal preference is, then, for a grade of Active Members equivalent to the "Members" plus the "Senior Members" of proposition number 2, and a grade of "Fellow" as above indicated. I would heartily support as a compromise proposition number 2, with the grade of "Fellow" added. My vote will be for proposition 2, since it can later be modified into what I consider more desirable, with the least serious complications. If any considerable number feel somewhat as I do, however, that an intermediate plan is preferable, the result may well be that the vote is so divided between propositions 2 and 3 as to prevent the adoption of either. In this case I hope an opportunity to pass on some compromise measure will be offered. If the present vote does not make clear the feeling of the Society, might not a questionaire on such individual points as the lower limit of membership, whether or not any distinction should be made between forest-school graduates and others, and, if so, in what grades, the establishment of a restricted honorary class, etc., be advisable to clarify the situation before presenting other concrete problems which must be accepted or declined in their entirety?

The proposition to make women eligible to any grade, to establish an Executive Council, to permit affiliation of forestry schools and clubs, to encourage the formation of Sections, and to increase the dues meet with my hearty approval. And I am particularly glad to have the opportunity to vote in favor of the amalgamation of the Proceedings and the Quarterly.

Burt P. Kirkland:

Permit me to make the following brief comment on the proposed reclassification of Society membership:

In this discussion I am proceeding on the theory that the chief function of the Society is to upbuild the profession of forestry. It is at the same time necessary, as pointed out by Mr. Hill in the April Proceedings, to maintain such a high standing of the Society as to make a strong appeal for membership, in part because of the honor involved. I have long agreed with Dr. Fernow that both of these objects can be attained only by a reclassification of membership. I also agree with Mr. Hill that in order to maintain the standards of the Society limitation of the voting power to the higher grades of membership is necessary.

The plan in column 2 will not increase the membership materially and has nothing to recommend it, so far as I can see.

In my judgment, the reclassification proposed in column 3 of the ballot will meet both of the requirements mentioned above. The admission of

Junior Members should provide large additional revenue, which will enable the Society to give far more liberal support to its publications and other urgent activities. It will also extend to the Junior Members the comradeship of older members of the profession at a time when such comradeship should be most effective in shaping the professional ideals of young foresters. I am of the opinion that such association and restraint will be more effective in the formation of right ideals than any formal statement of professional ethics that might be adopted for imposition in later life on Society members.

The experience of other technical societies justifies us in the belief that limitation of the voting power to "Member" and "Fellows" will result in maintaining the standards of the Society. In fact, these standards will, I believe, be gradually raised by the gradation in membership, because only those who prove very worthy Juniors or Associates will be advanced to "Members," whereas under the present system mistakes in admitting members are bound to occur in some cases through being too liberal; in other cases through being too strict.

In view of these considerations, I should support the membership classification proposed in column 3 of the ballot were it not for two particulars taken in conjunction with each other. The first of these is the last paragraph of Article III, Section 1 (third-ballot column), limiting all elective and committee positions, even on the editorial board, to "Fellows." Undoubtedly nine out of ten of the present elective officers of the Society would qualify under this provision. In the case of committee positions some of the present members of the editorial board will certainly be disqualified. It is, in my judgment, most unwise for the Society to deliberately cut itself off from the best and most energetic work it can secure, especially in committee positions. Probably there would be little effect on the elective positions; but the limitation of committee assignments to "Fellows" basking in the light of "achievement" will surely leave the committee work oversupplied with "experienced advice" and short of the energy of those who still have their reputations to make.

This is very serious, even when standing by itself; but coupled with the fact that "Members" are not even permitted to elect the "Fellows" it is fatal, especially in view of the following facts: Complete data are not at hand; but I estimate from the membership list of January, 1916, that not over 100 of the 253 Active Members can qualify at once for election as "Fellows" by length of service. This is on the basis that few who entered the Society later than 1908 can qualify. Obviously the other qualifications, if rigorously applied, would eliminate probably 50 per cent of these, so that the changes proposed in column 3 will hand entire control

of the Society, now invested in over 250 Active Members, over to a small group of 25 to 50. This group will be, moreover, self-perpetuating—an oligarchy, as Mr. Clapp says.

I also feel it necessary to make another point against the plan. Since most of the directive positions in forestry are in the Federal Forest Service and research funds controlled by the same authority, there is no question that in voting for this scheme the Active Members will deliver complete and perpetual control to the Service. This is true, because most of the "Fellows" will be in Federal employment and because changes in the constitution will be in the hands of the "Fellows." Moreover, since higher officials of the Service will naturally occupy the most important positions in the Society, and since it would be against all human nature for the average subordinate to act contrary to his superior, even in Society affairs, we should see one-man control of the Society from time to time—a condition we have quite closely approached at times in the past. If the Forestry Quarterly is turned over to the Society (which the writer favors if there is a chance for a hearing assured to all the profession, whether members of the Forest Service or not), it is obvious that free criticism is in danger of being suppressed in the profession for some time to come. This would be a far more serious thing to the average man in the Service than to those outside.

This consideration will, I am certain, defeat an otherwise extremely urgent reform, even if it had a chance to win a three-fourths vote under the scheme of balloting, which latter is well calculated to deprive any plan of a favorable vote through the splitting of the vote into three parts. Since it seems very necessary that a reclassification of membership be made, I feel that, as there is still time, the Executive Committee should at once resubmit to the members changes in Article III, leaving only choice between the present plan and plan III, omitting therefrom limitation of office-holding to "Fellows" and providing for election of "Fellows" by "Members." With these changes made, I do not see how there could be objection made to it, since present Active Members would be deprived of no rights, but, on the contrary, have an additional one granted, viz., the possibility of being raised to the grade of "Fellow."

Theodore S. Woolsey, Jr.:

The membership of the Society of American Foresters may be (1) exclusive, (2) popular, or (3) a combination of (1) and (2). To make the membership in this Society of permanent value to the professional foresters of the United States and to make it mean something, it appears

logical that it should on the whole be exclusive rather than popular. The American Forestry Association is the popular "society" to which any one may belong. Without question, the writer is strictly in favor of increasing the difficulty of admittance to the highest class of membership rather than lowering it. To mean anything the "Fellow" membership must be limited to men of very high professional attainments. It does not appear wise (as has happened in the past) to elect on the basis of mere administrative rank. It is unquestionably true, judging from forest history, that men in the highest administrative positions who have produced nothing are soon forgotten. Rigid minimum age restrictions, as explained further on, should be omitted. My own preference is for three membership classes as follows:

1. "Fellows," but without a minimum age. A minimum age limit is too arbitrary. Instead it would be sufficient to provide that Fellows cannot be elected until they have served as members at least 5 to 8 years. Probably a third of the present Active members would be Fellows.

2. "Members" about as defined at present as "professional foresters of achievement," with perhaps a shade lower standard of admittance.

3. "Associates" as defined under the present by-laws. Such a class as "Juniors" seem unnecessary, nor are the terms "Senior" or "Junior" members to my liking. Fellows alone should hold office; Members should vote, but be ineligible for office; Associates should neither vote nor hold office. Fellows should be proposed by a membership committee, but be confirmed by a two-thirds vote of the suffrage members, and Associates should be passed by the membership committee without the requirement of a membership vote for confirmation.

This brief statement has been purposely limited to principles rather than to include exact details. But should a large number of Active Members agree with these principles the writer would gladly draw up a third form of by-laws to be voted on. It is rather hard, to my notion, to have to choose between plan number 1 or plan number 2 as now drafted in the circulars.

David T. Mason:

I oppose the proposed changes in membership listed as the third alternative on the ballot sheets. It is believed undesirable to permit the membership of forest-school students. These men are not yet foresters, and it remains to be seen whether or not they will ever become foresters. With rare exceptions, they have not yet gained a broad outlook on the profession of forestry. Membership in the Society would, in my judgment, mean little to them. The forestry clubs in the various schools,

which may become affiliated with the Society under the existing Constitution, are exceedingly desirable, for they develop the interest of the student in forestry in general, develop loyalty to his school, and promote a hearty good fellowship with his fellow-students. The Society should do all possible to encourage these forestry clubs. It is not evident how the student or the society would benefit from having students as members of the Society, excepting that such student members would thus become subscribers to the magazine.

The Associate Member classification is apparently designed to include men engaged in the practice of forestry, who have not received technical training in a forest school, and who have not yet done sufficiently high-grade work to qualify them for a higher degree of membership. Apparently no arrangement is made in the Associate membership class for men who are doing excellent work in lines closely allied to forestry, but who are not actually practicing forestry. To my mind, men who are practicing forestry should be wholly ineligible to Associate membership. For any of the grades of membership it is believed undesirable to draw lines on the basis of the form of education.

A class of membership to provide for "Fellows" I should be glad to see; it is believed, however, that this is not yet an important matter. If such a class is created, the holding of offices in the Society should not be restricted exclusively to its members. Furthermore, if such a grade is established, it should be much less an automatic matter of age and holding a responsible position, and much more a means of honoring exceptionally high-grade achievement, than indicated in the proposed amendment.

For the present grade of Honorary Member no provision seems to be made, although it is presumed that it is intended to keep this grade. To my mind, it is undesirable to create very many grades of membership, especially with distinctions based more or less on form of education.

I favor the proposed amendment with regard to members listed as the second alternative. These amendments are simple in character and permit in an easily understood way one of the things which is most needed by the Society at present—that is, the membership of a large number of practicing foresters in the country who are clean, honorable men, but who have not yet achieved sufficiently to qualify for membership in the Society under the present Constitution. The Society is greatly in need of these men: these men can be benefited by the Society. If this amendment is adopted, it will not prevent a later amendment to provide a class of Fellows whenever most of the Society believe such a step desirable.

I am in favor of having women received as members of the Society on the same basis as men. I know of no valid argument against such a

movement; all of the reasons in favor of having a Society at all tend to justify receiving properly qualified women as members.

The amendment to create an Executive Council is, in my judgment, highly commendable, for it will correlate the work of various officers and committees of the Society in a way which will make the work of the Society far more effective.

The amendment should be passed reducing from ten to five the necessary signatures on applications for the formation of sections, for they are an exceedingly desirable feature of the Society; their benefits should be extended as rapidly as possible to other parts of the country than those in which they now exist.

The organ of the Society should go only to those who pay for it, either through dues or regularly paid subscriptions. The amendment relating to this matter should pass.

It is highly desirable that the dues of the Society be increased. At present the dues are pitifully low. It is disagreeable to think of a professional society, which should be strong, flourishing, and progressive, since it is made up mainly of men who are anything but stand-patters, struggling along with such a meager allowance as at present. Personally I should like to see the dues decidedly higher than is proposed by the amendment. It is very desirable that the Society have ample funds at its disposal, and that it have a paid secretary as soon as possible. The right sort of man in the position of paid secretary, with all of his time to devote to the work, could increase the influence of the Society enormously and in a way which would be of great advantage to the whole profession and to forestry in general in America. The Society and the whole profession at the present time, to my mind, is not putting things through with any real punch. We are lethargic when we should be wide awake; we are on the defensive when we should be on the aggressive. We need a lot more real life. I believe that most members realize this. We need a better organization. I believe that one of the best ways to get it is to raise the dues sufficiently to employ continuously a high-grade secretary who can give his time to providing the necessary stimulation.

The amendment providing for the amalgamation of the Proceedings and the Forest Quarterly is an exceedingly desirable one, for the reasons clearly given in the comments of the Secretary of the Executive Committee. It is also desirable to adopt a new name for the Society organ, since the designation "Proceedings" will be even less appropriate after the amalgamation than it is at present, and the name "Quarterly" will be wholly inappropriate, since for the present the publication will appear eight times annually. Doctor Fernow's generosity in encouraging the

amalgamation deserves the hearty thanks of the members of the Society, and his willingness to act as editor-in-chief insures the success of the enterprise. May the amendment win and may Doctor Fernow be able to give his time to this work for many years to come.

Barrington Moore:

The need for change in the membership of the Society of American Foresters is so generally admitted as to require no argument. That the change should carry with it some sort of a classification of the members is also pretty generally conceded. We wish to increase our membership, but do not want to throw open the door unreservedly and become a "pay-as-you-enter" association.

The objects of the change and of the classification are, in brief, to raise the standing and increase the influence of the Society, both among foresters and the general public.

Two plans designed to serve these objects by classifying the membership are before the Society. The first plan provides that advancement within the Society be based on achievement; the second that advancement be based on seniority. Which of these two principles—achievement or seniority—will serve the best interests of the Society, the profession, and the individual members?

The Society will unquestionably be stronger and command greater respect if its policy is controlled by men of achievement than if controlled by men of a certain age and length of service.

The profession will benefit in two ways by the first plan. The more powerful the Society the more powerful the profession and the greater its opportunity for service. Any profession is judged by the influence and standing of its society among similar societies of other professions. Secondly, each man will be encouraged to put forth his best efforts if he can secure full membership in the Society only by achievement.

The individual will gain more under the first than under the second plan. In the first place, the incentive to achievement will benefit each man as much as it does the Society and the profession, for the interests of the individual and of the profession are one. Secondly, Senior membership carries with it a certain prestige, in that it serves as a recognition of ability. This prestige is lacking under the second plan.

Some men consider prestige valueless to foresters because their employment is largely by governments. True it is that the money value of prestige will be less than in engineering professions, where increased prestige means increased business. And if most governments and employing for-

esters fall into the insidious habit of basing promotion solely on length of service rather than on merit, prestige will of a truth become well-nigh meaningless. This seems to be the anticipation of those advocating the second plan.

But do any of us want seniority rather than merit to control advancement? Doubtless it is more comfortable to plod along until a certain number of years of creditable service brings promotion; but this way lies loss of creative effort, with consequent loss of influence among other professions and the general public. The very character of our work, its isolation and its steady government employment, tend toward stagnation. It requires the best efforts of every forester to keep himself, and the profession with him, from falling into a rut. Yet we have before us a plan of membership, basing advancement on seniority, which proposes to take the first step in the direction which we are all striving so hard to avoid!

The first plan is lacking in one respect. The incentive to original work ceases after election to Senior membership. To remedy this there should be a class of Fellows representing the highest ability in the profession. Election to this class should be accorded only for the greatest distinction and should be the highest honor which the profession can give. Provision for the election of Fellows can, however, well afford to wait a few years.

The change in membership is the most important matter which has yet come before the Society. Bound up in this change are not only the influence of the Society within the profession, but also the standing of forestry before all other professions and the general public.

In Vol. XI, No. 3, an error was made by the printer in assembling the pages in a few of the copies of the Proceedings. Two complaints have been received that pages 303 to 318 were duplicated, and that pages 335 to 350 were omitted. If any one has received one of the defective copies and will return it a new one will be furnished.

The Executive Committee of the Society of American Foresters has approved the establishment of a section of the Society in Washington, D. C., to be known as "The Washington Section of the Society of American Foresters," in accordance with the provisions of Article 8 of the Constitution of the Society. This Section is to be governed by the following **By-Laws:**

SECTION 1. The name of this organization shall be the Washington Section of the Society of American Foresters.

SEC. 2. The membership of the Section shall consist of all active members of the Society in good standing resident in the District of Columbia. Members of the Society who reside at points outside of the District of Columbia may also become actively affiliated with the Washington Section upon written application.

SEC. 3. The officers of the Section shall consist of a Chairman and a Secretary. They shall be elected by plurality vote at the first regular business meeting of the Section in each calendar year, and shall serve for a term of one year, or until their successors are elected. These two officers, with one other person to be similarly elected, shall constitute the Executive Committee.

SEC. 4. The Chairman shall preside at the meetings of the Section and shall perform all other duties incident to this office. The Secretary shall keep the minutes of the Section, shall conduct its correspondence, shall announce its meetings, shall be custodian of its records, shall collect all moneys due the Section, and shall have custody of all moneys received.

SEC. 5. The Executive Committee shall control the expenditure of all funds and shall select the speakers, subjects, and dates for meetings of the Section. In the absence of the Chairman the third member of this Committee shall preside at meetings of the Section, and in the event of the latter's absence also the Secretary shall preside. Two members shall constitute a quorum in this Committee.

SEC. 6. The election of officers or other important business shall be undertaken only at meetings of which all members of the Section have been notified at least three days in advance. At such business meetings seven members shall constitute a quorum.

SEC. 7. Open meetings of the Section shall be held at Washington, D. C., at such times and such places as the Executive Committee shall decide. The purpose of these meetings shall be the interchange of ideas on subjects of interest to the profession of forestry and shall be open to friends and members.

SEC. 8. There shall be no stated dues. The Secretary shall collect by assessment from the members present at any business or open meeting such amounts as the Executive Committee may find necessary to meet the incidental expenses of the Section.

SEC. 9. These By-Laws may be amended by a two-thirds vote of the members present at any business meeting.

At an informal meeting held Monday, October 9, steps were taken leading to the permanent organization of this Section and provision was made for the first called meeting on Thursday, November 9. All resident active members of the Society automatically become affiliated with the local Section, and other active members of the Society may affiliate by addressing Francis Kiefer, Temporary Secretary, Forest Service, Washington, D. C.